CLASSIFICATION AND CAUSAL MODELING OF
ECONOMIC INDICATORS OF INSTABILITY
IN DEVELOPING NATIONS

THESIS

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THESIS

Presented to the Faculty of the School of Engineering

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the

Requirements for the Degree of

Master of Science in Operations Research

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March 1990

Approved for public release; distribution unlimited

Preface

This research effort explored the relationships between quarterly economic data and an aggregate stability index in two representative developing nations. The objectives were to determine if any of the economic series could be classified as significant leading, lagging, or coincidental indicators of instability and to develop predictive models. Graphical and cross-correlation analysis were used to classify the economic series and regression, logit, cluster, and factor analysis were used for the predictive models. The results were encouraging, although not definitive.

This research was initiated through Professor William Lesso of the University of Texas during his stay at the Defense Intelligence College. I greatly appreciate his interest in both the project and my own welfare. I would like to thank the sponsor, Mr. Larry Nix of DIA/DB5-E3, and also Mr. Dave Jenkins of the CIA for their helpful and timely inputs. I would also like to thank my advisor, Lt. Col. Jim Robinson and my reader, Professor Dan Reynolds for their guidance and time. Lastly, I wish to thank my wife, Shelley, for her understanding and encouragement of my hobby for the first six months of our marriage.

James W. Wisnowski

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Abstract

This study examined the relationships between several quarterly economic time series and an aggregate stability index for developing nations. The hypothesis is that worsening economic conditions in developing nations may be a driving force behind unstable conditions in work, social, military, or political domains. The objectives were to identify economic time series that may serve as indicators of instability and to develop a predictive methodology of instability given the economic input.

Classification of the economic series paralleled the U.S. economic indicators of the business cycle. The series were classified as leading, lagging, coincident or unrelated to the instability index. Graphical and cross-correlation analysis were used to determine the type and strength of these relationships.

The causal models used regression, logit, cluster, and factor analysis. Regression analysis using both principal components and relative change values from the previous period was used to see if a subset of the economic series was statistically significant when regressed against the stability index. Logit analysis was used to map a probability of instability given the economic conditions. Cluster analysis on the economic data was used to see if the

groups of observations had any significant relationship to the stability index. Factor analysis was used to assess the dimensionality and to determine if certain factors could be associated with stability based on factor scores and factor loadings.

CLASSIFICATION AND CAUSAL MODELING OF ECONOMIC INDICATORS OF INSTABILITY IN DEVELOPING NATIONS

I. Introduction

General Issue

Due to increased U.S. and Allied interest in many developing nations, the U.S. intelligence and other departmental agencies continuously monitor indicators of incipient instability in these regions. This instability is unfavorable and the associated unpredictable activities could seriously threaten the nation's political or socio-economic base.

The indicators may be political, military, economic, or social and are the means by which intelligence agencies detect and predict the unstable events. The most desirable characteristics of the indicators are timeliness, relative importance and accuracy. Thus, the intelligence agencies are constantly looking to improve the current indicator base and introduce new sources of reliable indicators.

Problem Statement

The objective of this research effort is to classify several economic time series as leading, lagging or coincident to instability in developing nations and

determine a methodology to predict the level of stability given a set of economic series.

Background

The United States has a high interest in all developing nations for primarily political and economic reasons. Political motivations may include the continued pursuit of global democracy, the implementation or preservation of national peace and stability, or the protection of citizens' rights within the nation. Economic motivations may include protection of capital investment and loans, reliance on trade markets, or the general humanitarian interest of satisfying the basic needs for the inhabitants. There are countless additional reasons for U.S. interest in the third world, but these examples are sufficient motivators for this research.

All of the U.S. interests described above would be jeopardized in the event of significantly unstable events such as an overthrow of the government, assassinations, riots or other politically motivated violent actions. The U.S. would want to prevent, if possible, or at least mitigate the consequences of the instability as soon as possible to protect its interests. The earlier a destabilizing event is predicted or detected, the more options the decision makers will have and the more effective the responses will be.

Thus, there is a need for a timely and accurate indications and warning system for instability problems in developing nations. The internal instability is most often caused by a complex interaction of political, social, economic and military variables. Appendix A is a detailed list of questions concerning these and other categories of instability. The questions provide specific examples and insights into the analytical process used by the CIA in indications and warnings assessments.

The following examples of indicators are common examples found in numerous sources and in most cases intuitively obvious. Social indicators of instability may be the activities of insurgent or opposition groups, changes in urbanization and population rates, and ethnic or religious group dynamics. Military indicators may be reports of coup plotting, discontent over benefits or government policy, or arms transfers from other nations. Political indicators of instability may include recent unpopular governing regime policies, the population's decreasing support for the government, opposition groups' plans, capabilities, and support, or demonstrations. Labor strikes and general economic conditions are economic indicators useful in predicting instability.

It is the task of the U.S. intelligence agencies to continuously monitor all of the indicators for every nation to see if they remain within a tolerable range before

increased attention is required. This attention may range from requesting more analysts or data on the particular nation to sending financial or military aid to support the regime or opposition. Currently, the intelligence agencies do not have enough human resources to adequately monitor the large volume indicators for every nation, especially third world nations.

Previous Related Work. There is a surfeit of research on economic indicators in the United States and other market economies based on the business cycle, but very little empirical research has been performed for the application of the economic indicator to the third world. Sallie summarizes several statistically significant findings between political instability and socio-economic conditions in his dissertation. His general conclusion from previous empirical research in obscure documents was political instability is directly related to psychological dissatisfaction, relative deprivation, level of development and modernity, and the inequality of land distribution (Sallie, 1981:138). Specific findings from Sallie are summarized in Table 1.

Table 1. Political Instability Relationships (Sallie, 1981:138-144, 318)

NAME	CONCLUSION
Gurr	Civil strife is significantly correlated with deprivation.
Feierabends	Political instability is a function of frustration, literacy and modernity levels.
Russett	Violent deaths, GNP and inequality of land distribution are mildly correlated.
Johnson	Overall level of societal well-being is more critical in political instability than income equality.
Flanagan & Fogelman	Percent of agricultural labor and GNP inversely related to domestic violence.
Robin & Schainblatt	Energy consumption is inversely proportional to internal war.
Rummel & Hudson	No relationship between mass violence and economic development.
Duff & McCamant	Economic dependency (on imports or export product, aid, or foreign capital) is <u>not</u> related to repression or violence in Latin America.
Sallie	Significant relationship between inflation and internal war and also between dependency and political instability.

Desired Outcome

The objective is to provide insight into the trends and characteristics of instabilities as a function of economic conditions. This objective further breaks down to classifying the economic series as leading, lagging, or coincident to the instabilities and developing a causal relationship useful in predicting the level of stability

given the set of economic series. Summarized, the objective is to transform the raw data via analysis into useful information called indicators.

Achieving the objective has several encumbrances. The delayed reporting of economic time series is the major constraint of the usefulness of this analysis. Other constraints on accurate instability predicting are the importance of external events (such as natural disasters) and the lack of rational and predictable human behavior in many third world nations. Thus, the most important conclusions will be general relationships between stability and economic time series

Scope

Due to the broad nature of international instability and economics, a major effort of this thesis is to narrow the problem and reach general conclusions. The intent of this research is not to provide the intelligence agencies a "black box" model where they input the specific economic series for any nation and receive a composite stability index as output.

The availability of data on an aggregate stability measure requires the first observation for each time series to be Quarter I, 1980 and the last quarter included is dependent upon the recency of economic data reporting.

Two nations are selected for this study, Country A and Country B. Country A has a history of externally driven

political instability ranging from civil wars to government overthrow. Country B has been relatively stable from Quarter 1, 1980 to the present and the primary cause of instability appears to be directly related to the economy. Thus, a causal relationship linking stability and economic series is a priori more likely to be seen in Country B than Country A.

II. Literature Review

Introduction

The objective of this section is to review the literature pertinent to clarify concepts of economic indicators and econometric techniques applicable to predicting instability in developing countries. This review should provide sufficient technical background information and further justification for this research effort. Due to the scope of global economics, this literature review is narrowed to only address stability, economic indicators, multiple regression models, and multivariate analysis techniques. These areas are useful in providing the required background on some of the technical aspects of the research.

Stability

Gandolfo contends "a system is stable if, when perturbed slightly from its equilibrium state, all subsequent motions remain in a correspondingly small neighbourhood of the equilibrium." (Gandolfo, 1987:461) The sponsors of this research, the Defense Intelligence Agency, Global Analysis Division, DIA/DB5-E3, are primarily concerned with the significant political instabilities and the associated relationships to the economic climate. Thus, political instability is the surrogate for overall instability and is the response variable in the models.

Political Stability. Political stability can be characterized by the relative predictability of government actions and policies, the relatively harmonious foreign and domestic relationships, and the sense of security against a military threat (Hayes, 1984:2). Political instabilities are often regime-threatening and may be any one or a combination of the following four categories: (1) collective or mass protests (riots, anti-government demonstrations and political strikes), (2) internal war (guerrilla attacks, combat deaths), (3) military coups (irregular executive transfers and assassinations), and (4) government repression (constitutional rights infringements, arrests, exiles, execution and media censorship) (Sallie, 1981:8). Political instability is most likely to occur after a long period of economic and social development followed by a sharp reversal of the trend (Sallie, 1981:123).

The economic conditions of a developing country often contribute significantly to the politically unsettled situations, particularly when basic commodities are adversely affected. Hayes adds most insurgent activity and political unrest in developing nations is economic based and generated from within a nation, but actually planned and run by groups from other nations with controlling interests (Hayes, 1984:1).

Economic Stability. Economic stability, in general, is not easily defined and has not been standardized within any agency or in any document. Authors write about particular conditions and policies that are destabilizing to the economy, but none have actually set forth a formal objective definition of this abstract concept. The Defense Intelligence Agency also has no formal or operational definition of economic instability (Nix, 1989).

For developing countries, economic instability is often manifested in excessive balance of payments deficits and uncontrollable increases in the rate of inflation (Cline and Weintraub, 1981:1). Several sources and indications of internal and external economic instabilities have been identified (Black, S., 1981:46). The internal sources include domestic crop failure, significant changes in fiscal and monetary policy, politically motivated investment projects, increasing wage rate differentials, domestic and foreign investment, and political instability. External sources include trade volume, foreign capital access, exchange rate adjustments, and import and export incentives. The interaction of some of these economic series with an aggregate measure of stability will be the focus of this analysis. This research will look at economic series from both internal and external sources.

Business Cycles

U.S. economic stability is often measured by a collection of economic indicators. Classification of U.S. economic indicators is based on the business cycle. This framework appears to be applicable only to market-based economies based on current literature. The definition and discussion to follow on business cycles will be useful for insights into the economic indicators discussed in the next section.

Business cycles refer to the overall trends and oscillatory patterns in economic activity characterized by peaks and troughs. The National Bureau of Economic Research adopted the following definition from business cycle research pioneers Arthur Burns and Wesley Mitchell in 1937:

> Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic; in duration business cycles vary from more than one year to ten or twelve years; they are not divisible into shorter cycles of similar character with amplitudes approximating their own. (Moore, 1982:96)

The business cycle describes the overall (aggregate) economic conditions at the time. Black points out the degree to which a cycle tends to affect many different measures of economic activity is called the diffusion index (Black, F. 1981:76). The most important measures of

aggregate economic activity to the business cycle in market economies are income, output (GNP or GDP), employment and trade (Klein and Moore, 1985:7).

Economic Indicators

Wesley Mitchell first developed the concept of economic indicators in 1937 because he felt the business cycle could be mathematically described and predicted by several key economic time series (Klein and Moore, 1985:3-4). The primary purpose of the indicator system is to measure, detect, forecast and appraise recessions and recoveries (Moore, 1980:351). These indicators are classified by their behavior in relation to the business cycle as being either leading, roughly coincident, or lagging. The original set has been periodically updated through the years to account for the dynamic U.S. economic environment. Historically, there has been no single indicator to outperform all others, thus requiring the need for a large set of indicators for complete analysis (Moore, 1980:15).

A direct application of the economic indicator, classified as a function of the business cycle, is not possible for developing nations (under the assumption there is no business cycle in these regions); however, the business cycle could be substituted with an aggregate index of national stability. The following discussion is for indicators as they apply to market economies, but many

relationships and results may be useful when applied to the stability index.

Leading Indicators. Leading economic indicators are those economic time series which move several months before, but in the same direction, as the business cycle. Leading indicators have historically been the ones of greatest interest because of their capability to forecast near-term economic conditions. The leading indicators identified in the U.S. are: average workweek and overtime, hiring and layoff rates, new unemployment claims, new investment commitments, formation of business enterprises, inventory investment and purchasing, sensitive commodity prices, stock prices, profits and profit margin, cash flow, money and credit flows and, credit delinquencies and business failures (Moore, 1980:306-7).

These leading indicators are basically measures of anticipation of future resource commitments and are highly sensitive to changes in the economic environment (Klein and Moore, 1985:8). Due to this economic sensitivity, they are more erratic and show more cycles than the coincident and lagging indicators (Moore, 1980:358). Another important characteristic of leading indicators is they give indications one to two quarters earlier of the relative severity of a recession prior to the contraction phase (Moore, 1980:365).

The new business formation indicator provides a simple but illustrative example of why leading indicators lead. Once an application has been filed to start a new business, it can reasonably be assumed this business will require additional labor and capital resources from the current pool in the near future. The purchase of these resources directly affects the state of the economy (albeit on a small scale). Thus, the leading indicators represent the initial phase of the decision process to invest resources into the economy (Moore, 1980:310).

Roughly Coincident Indicators. Coincident indicators are those economic time series which move approximately simultaneously with the business cycle. These indicators are generally broad, comprehensive, or aggregate measures of actual business activity from both the input and output side (Zarnowitz and Boscham, 1977:195). The coincident indicators should firm up the conclusions the leading indicators suggested. (Zarnowitz and Boscham, 1977:195) Coincident indicators often lead at peaks and closely coincide with the troughs (Moore, 1980:355). The U.S. roughly coincident indicators are job vacancies, total employment and unemployment, total production, income, sales, backlog of investment commitments, wholesale price index for industrial commodities, bank reserves, and money market interest rates (Moore, 1980:306-7).

Lagging Indicators. Lagging indicators are those economic time series which move in the same direction several periods after the business cycle. Due to the slow reaction to the economic climate, the lagging indicators are usually smooth series and help confirm the erratic indications detected by the leading and coincident indicators (Klein and Moore, 1985:8). Lagging indicators can be classified intuitively as those associated with the cost of production of end items. The U.S. lagging indicators are long duration unemployment, investment expenditures, inventories, labor cost per unit of output, outstanding debt, mortgage and bank loan rates (Moore, 1980:306-307).

Since business cycles are hypothesized to be infinitely repetitive, many economists have theorized these lagging indicators can be mathematically transformed (usually inverted) into leading indicators. These series are interest rates, labor costs, manufacturing and trade inventories, outstanding business loans, and cost of doing business (Zarnowitz and Boscham, 1977:195). Klein and Moore report historical U.S. evidence shows the inverse of the lagging indicators is statistically significant in leading the leading indicator (by an average of six months) (Klein and Moore, 1985:114). Lagging indicators are therefore useful in both confirming the current cycle's phase and detecting the next phase.

International Applications. The economic indicator methodology has been validated with all of the U.S. recessions in the past fifty years. Due to this domestic success and the increased attention on explanations of global economic conditions, this indicator system has been expanded to other industrial and a few developing nations. Moore gives four justifications for an international indicator system: (1) To promptly detect global recession and recovery. (2) To measure the scope, severity and unusualness of a current recession. (3) To appraise the prospects for foreign trade. (4) To develop an effective indications and warning process for the accelerating rate of inflation (Moore, 1980:74). Recently the International Monetary Fund (IMF) advocated the increased use of a limited set of economic indicators. The IMF plans to use this set of indicators for appraising the overall global developments with particular interest in the relationship between developing and industrial economies (Crockett, 1988:23).

Multiple Linear Regression (MLR)

This econometric analysis technique is included in this chapter only superficially in the capacity as a review to most readers of the general framework and particularly the associated model assumptions. Violation of the assumptions may suggest or dictate the model functional form. This discussion begins with the basic regression techniques and progresses to more complex forms.

The objective of MLR is to fit a model that best estimates a set of response variables $\underline{Y}$ (level of instability) based on a given set of known independent variables $\underline{X}$ (economic indicators). The general model is $\underline{Y} = \underline{X\beta} + \underline{e}$ where $\underline{\beta}$ is the estimated coefficient matrix and $\underline{e}$ is the vector of random error terms. The error can be caused from simplification of reality, missing variables or the accuracy of the data measurement.

The most common method for estimating the above model is ordinary least squares (OLS). OLS seeks to fit a regression line through the data minimizing the sum of the squared distances between the fitted line and the actual data points.

The assumptions associated with OLS are as follows:

(1) The relationship between $\underline{Y}$ and $\underline{X}$ is linear in the parameters (the first derivative does not contain any $\underline{\beta}$ terms).

(2) $\underline{X}$ is known with linearly independent columns.

(3) The error term has a mean of 0, a constant variance of σ^2 and a normal distribution.

(4) The errors are not statistically correlated (Pindyck and Rubinfeld, 1981:47).

<u>Variable Classification Schemes</u>. MLR uses a variety of classes of both independent and dependent variables. There are instances when data (particularly economic) is naturally discrete or discretely recorded. The qualitative response

model is the term applied to discrete dependent variable models. The most common qualitative response models are 0, 1 binary responses (known in econometrics as dichotomous responses). A relevant example is $Y_i = 0$ represents stability and $Y_i = 1$ is evidence of instability. Polytomous (finite discrete variables at more than two levels) can be divided into three categories (Maddala, 1983:34). Polychtomous variables may have mutually exclusive and unrelated categories (airplane, bus, car, or train for mode of travel). The ordered response variable indicates degree (negligible, moderate, substantial, or serious for level of concern). The sequential response variable maps into a time-ordered specified sequence (lieutenant, captain, or major for rank).

This research effort is concerned primarily with ordered and dichotomous response variables and independent variables with individual observations (as opposed to categories). This is due to the continuous nature of the economic time series considered and the discrete values for the level of stability in the response variable.

Limited Probability Model. The limited probability model is an extension of the least squares estimates for a dichotomous response regression. The actual response variables are 0 or 1, but the expected values are interpreted as the probability of observing the given qualitative characteristic (instability, for example) given

the set of independent variables. The model does not take into account the elementary result from probability theory that the probability cannot be less than 0 or greater than 1, so it compensates by mapping any result greater than 1 to 1 and less than 0 to 0 (Pindyck and Rubinfeld, 1981:275). Intuitively, it is not difficult to see where this truncation procedure can lead to both parameter and variance estimation problems with the larger tails on the distribution. Also prediction bias is introduced because $Pr(Y_i) = 1$ states it is certain the response will occur given the input values, when in fact it is possible the response may not occur.

Another problem with this model specification is the variance of the error terms is not constant across the levels of input. This heteroschedasticity is easily shown because the residual ($e_i = y_i - \beta X_i$) term is assumed to be zero and can only take on one of two values, $-\beta X_i$ and $1 - \beta X_i$. The derivation using elementary expected value theory is shown below.

$$\text{Given } E(y_i) = \beta X_i \quad \text{then}$$

$$\begin{aligned} Var(u_i) &= \beta X_i(1 - \beta X_i)^2 + (1 - \beta X_i)(\beta X_i)^2 \\ &= \beta X_i(1 - \beta X_i) \\ &= E(y_i)[1-E(y_i)] \qquad (1) \end{aligned}$$

(Maddala, 1983:16)

Based on Equation (1), the variance will be higher for y_i values close to 0 or 1 and less near .5. Furthermore, the assumption of normally distributed residuals for least squares estimates is violated, making the standard statistical inferences no longer valid. Heteroschedasticity can be corrected by weighted least squares, but Pindyck and Rubinfeld caution against use in this application (particularly in small sample sizes) because of difficulties in estimating the variances of each y_i (Pindyck and Rubinfeld, 1981:276). Clearly, an alternative formulation is required to correctly specify a model of discrete response variable.

Probit Model. The probit (also referred to as normit) model corrects for the chances the predicted value or probability will lie outside the interval [0, 1] by using the cumulative normal probability distribution function transformation. The normalization of Xβ leads to the following relationship:

$$P_i = Pr(y_i = 1) = F(X\beta) = \frac{1}{2\pi^{.5}} \int_{-\infty}^{X\beta} e^{-.5U^2}\, dU \qquad (2)$$

where P_i = conditional probability the event occurs given X,
U = random variable normally distributed with a mean of zero and unit variance (Hanushek and Jackson, 1977:189).

The interpretation is the area under the standard normal curve between negative infinity and Xβ is equal to the probability of the event occurring. The objective is to

estimate $Z_i = F^{-1}(P_i) = X\beta$, which is the theoretical probability of the event's occurrence (Pindyck and Rubinfeld, 1981:282). The probit model cannot be estimated using OLS because of the nonlinearity of the normal probability distribution (Pindyck and Rubinfeld, 1981:283). The parameters can be estimated using the method of maximum likelihood discussed shortly.

Logit Model. The logit model has the same structure as the probit, except it uses the cumulative logistic probability function shown below:

$P = F(Z) = 1/(1 + e^{-Z}) = 1/(1 + e^{-X\beta})$ (Pindyck and Rubinfeld,. 1981:287).

Simple algebraic manipulation of this expression yields Equation (3), the log odds or logit equation.

$$
\begin{aligned}
P(1 + e^{-X\beta}) &= 1 \\
e^{-X\beta} &= (1 - P)/P \\
X\beta &= \ln[P/(1 - P)] \qquad (3)
\end{aligned}
$$

(Hanushek and Jackson, 1977:188)

Hanushek and Jackson prove that the change in probability of the event's occurrence due to a change in a single independent variable, x_k, could be found by taking the partial derivative of F(Z) with respect to x_k. The result is $\partial P/\partial x = \beta_k(p)(1-p)$ (Hanushek and Jackson, 1977:189). This result leads to the conclusion that changes

in x_k will have the greatest impact on the probability of occurrence near the center (.5) and less near the tails of the cumulative logistic probability distribution.

The probit and logit density functions are similar to one another (as shown in Figure 1) except for the larger tails of the logit (Hanushek and Jackson, 1977:188). Even recent works have shown only a handful of models with a

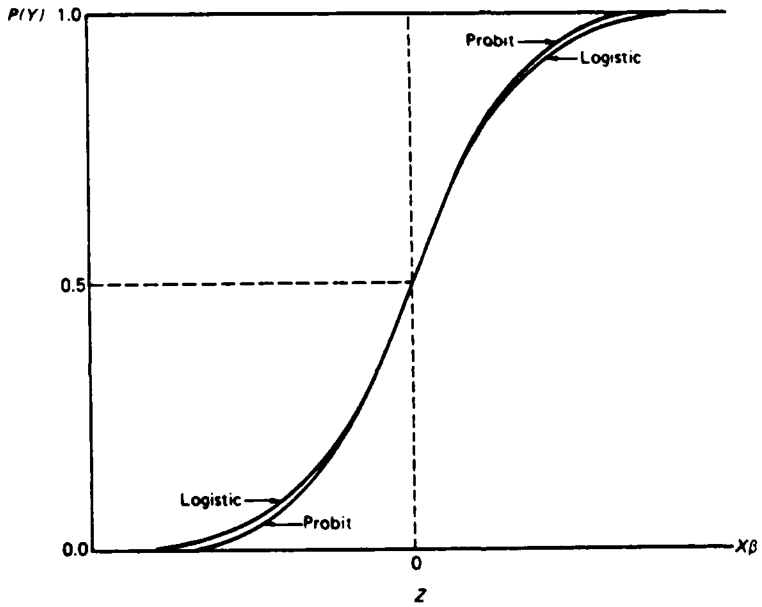

Figure 1. Probit Versus Logit Functions (Hanushek and Jackson, 1977:188)

large number of observations significantly distinguish between the probit and logit models (Amemiya, 1981:1502). The logit function, however, is generally preferred because of the computational ease and flexibility. Amemiya states multiplying the estimated coefficients from a logit model by 2.5 (and subtracting 1.25 for the constant term) will transform them into the probit estimates (Amemiya,

1981:1488). The use of a probit versus a logit model is dependent primarily upon the assumption of the underlying distribution of the error terms and the availability of software (Hanushek and Jackson, 1977:204).

<u>Least Squares Logit Estimation</u>. Least squares estimation is possible for the logit model provided the independent variables are grouped in contingency table format. The relative cell frequencies are estimated by P_i = (# occurrences across X_i)/(total number with X_i) where X_i would be some level of X, for example the number of quarters with inflation below 5% and the stability index equal to 1. This estimation causes significant bias in small samples and there must be a reasonably large number of observations within each cell (Pindyck and Rubinfeld, 1981:290). An additional weak assumption is each observation in the cell must have the same probability of occurrence in the model, which introduces considerable bias (Hanushek and Jackson, 1977:199).

<u>Maximum Likelihood Logit Estimation</u>. Logit estimation using individual observations requires maximum likelihood point estimation techniques due to the nonlinearity of the parameters. Maximum likelihood chooses the parameters of a distribution (the ß's) that best empirically support the observed responses over the entire sample (Hanushek and Jackson, 1977:344). For the

dichotomous logit model, the likelihood function L is shown in Equation (4). The mathematical properties of the

$$L = \prod_{t=1}^{T} P_t \exp(Y_t)\ (1 - P_t)\exp(1-Y_t) \qquad (4)$$

natural log make the equation easier to estimate and interpret as derived in equation 5.

$$\begin{aligned}\log(L) = L^* &= \sum_{t=1}^{T} Y_t \log P_t + \sum_{t=1}^{T}(1-Y_t)\log(1-P_t)\\ &= \Sigma\, Y_t \log P_t - \Sigma\, Y_t \log(1-P_t) + \Sigma \log(1-P_t)\\ &= \Sigma\, Y_t \log[P_t/(1-P_t)] + \Sigma \log(1-P_t)\\ &= \Sigma\, Y_t X_t \beta - \Sigma \log(1+e^{X_t\beta}) \qquad (5)\end{aligned}$$

(Hanushek and Jackson, 1977:201-202).

The estimated values of β that maximize the log likelihood function are found by taking the partial derivative of Equation (5) with respect to the individual β_k and setting them equal to zero. The mathematical expression is given in equation (6) below.[1]

$$\begin{aligned}\partial L^*/\partial b_k &= \Sigma\, Y_t X_{tk} - \Sigma\, [X_{tk}\, e^{X_t b}]/[1+e^{X_t b}]\\ &= \Sigma\, Y_t X_{tk} - \Sigma\, X_{tk}/[1+e^{-X_t b}] = 0 \qquad (6)\end{aligned}$$

for k = 1 to K independent variables.

(Hanushek and Jackson, 1977:203)

Nelson contends the maximum likelihood estimates are asymptotically equivalent to the least squares by a Taylor

series expansion of the log odds ratio about P_i for a large number of observations due to the distribution of the error term (Nelson, 1987:231).

<u>Newton-Raphson Approximation of the Maximum Likelihood Estimates</u>. The first derivatives of the likelihood equations set equal to 0 are the equations the MLE maximizes with respect to the parameters, β. The inherent nonlinearity suggests an approximation by numerical techniques.

Most software uses the Newton-Raphson Method, also known as Newton's Method of Tangents, to approximate these parameters. Figure 2 shows the basic principle behind this technique.

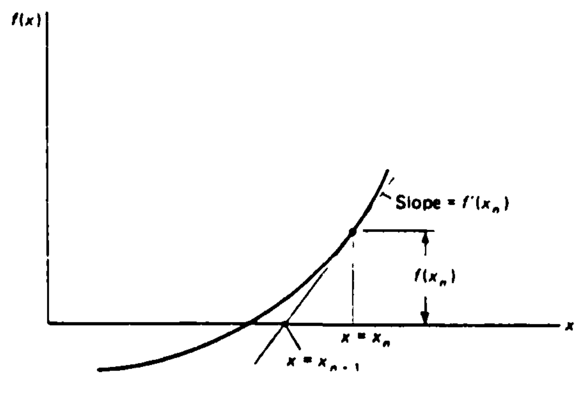

Figure 2. Graphical Representation of the Newton-Raphson Method (James, 1977:100)

From Figure 2, x_n is the first approximation and intersects the curve at $f(x_n)$. A tangent line to the curve at x_n intersects the X axis at x_{n+1} which is clearly a better estimate of the point on the curve where $f(x) = 0$. The slope of the tangent line, $f'(x_n)$, is rise/run = $f(x_n)/(x_n - x_{n+1})$. Simple algebra yields the basis for the iterative methodology of this technique, $x_{n+1} = x_n - f(x_n)/f'(x_n)$. Iterations continue until $|x_{n+1} - x_n|$ is less than a prespecified value (tolerance) or the number of iterations has been completed (James, 1977:101). This method requires an initial approximation for x_n; however, the robustness of the technique does not require a high degree of accuracy for this initial approximation (Maddala, 1983:49).

For the probit/logit approximations, the matrix of second partial derivatives is negative definite which satisfies the necessary and sufficient conditions for convergence to a global (as opposed to local) maximum (Maddala, 1983:49). Maddala also notes these equations will usually converge within four to ten iterations, depending upon the number of estimated parameters.

The Newton-Raphson algorithm yields a consistent estimate of the covariance matrix of X by taking the inverse of the negative matrix of second derivatives of the log-likelihood function (Nelson, 1987:231). The variance - covariance matrix is useful for tests of significance.

Goodness of Fit Tests. Goodness of fit tests are statistical measures of how well the model approximates the observed data. For the dichotomous model, Maddala suggests the following relationship to compute a measure of the variance explained by the model:

$R^2 = [COV(Y,p)]^2/[VAR(Y)VAR(p)]$ and by mathematical identities and algebra, $R^2 = VAR(p)/[E(p)-E^2(p)]$, where Y is a random variable equal to 1 with probability p and p is a known function of the explanatory variables (Maddala, 1983:38). Also a Chi-Squared value is a simple measure of the difference between the observed and expected responses.

Principal Components

Principal components is a multivariate data reduction technique whose purpose is to form a smaller set of variables that explains most of the variance from a weighted linear combination of the original variable set (Dillon and Goldstein, 1984:24). The first principal component accounts for as much of the variation in the original variables, the second principal component accounts for as much of the remaining variation, and the process continues until there are as many principal components as original variables. A desirable property of these principal components is that they are orthogonal to each other leaving no concerns for multicollinearity in regression analysis.

Most software packages report how much of the variation is explained in each principal component, so it may, for

example, be possible to need only the first two principal components to explain 95 percent of the variation contained in twenty or thirty variables.

Dillon and Goldstein recommend using either the covariance or correlation matrix due to unit and scaling effects (Dillon and Goldstein, 1984:26). The correlation and covariance matrix correct for the mean which make the variables directly comparable. The covariance matrix input allows for several statistical tests of significance to *determine if the eigenvalues of the principal components are different from zero. The number of principal components to retain is subjective and usually based on the cumulative percent of accounted for variation (Dillon and Goldstein, 1984:48).

Principal component scores are computed from matrix algebra with the original data matrix and the eigenvectors. These scores can be useful in identifying significant or outlying observations in the data.

Principal Component Regression. Multiple regression on these orthogonal principal component scores remedies the underestimated variance problem associated with multicollinearity. Principal component regression is using a subset of the principal components as the independent variables and running the regression as OLS. Joliffe warns that a subset of the principal components is required; otherwise, the same overestimation of variance problem seen

in the original set will occur (Joliffe, 1986:130). This subset can be determined by selecting a cutoff point for the eigenvalue (L^*) and use only those principal components with an eigenvalue greater than L^*. In practice, L^* is in the range of .1 to .01 (Jolliffe, 1986:135). Many authors do not use the L^* criteria because a principal component after this value may still be highly significant in the regression.

Estimation of the ß coefficients is done in principal component regression by Equation (7) below (Jolliffe, 1986: 134).

$$\underline{ß} = \sum_{k=1}^{M} 1/L_k \, \underline{a}_k \underline{a}_k \, \underline{X}'\underline{y} \tag{7}$$

where M = number of principal components in the subset
L_k = the eigenvalue (latent root)
$\underline{a}_k$ = the eigenvector for the k^{th} column.

Cluster Analysis

Cluster analysis is another exploratory data reduction technique. It groups observations or variables into similarly structured clusters that differ significantly from other clusters in meaningful ways. The objective is to have small variance within clusters relative to the variation between clusters (Dillon and Goldstein, 1984:158). The clusters are formed by minimizing absolute distances within the clusters.

One of the most common clustering algorithms is the average linkage algorithm where the distance between clusters is the average distance between all pairs of points in the clusters (Dillon and Goldstein, 1984:171). Equation (8) is the computational formula for the distance between objects in clusters I and J over all possible pairings (Dillon and Goldstein, 1984:172).

$$D = 1/n_I n_J \sum_i \sum_j \left[\sum_{k=1}^{p} (X_{ik} - X_{jk})^2 \right]^{.5} \qquad (8)$$

where n_I = number of observations in cluster I
n_J = number of observations in cluster J
p = number of originals variables

Factor Analysis

Factor analysis is a multivariate data reduction technique used to associate seemingly unrelated observable variables to unobservable factors. The number of factors retained defines the underlying latent dimensionality and simple structure of the data.

The basic model is $\underline{X} = \underline{\Lambda}\,\underline{f} + \underline{e}$ where $\underline{X}$ is the vector of observed responses, $\underline{\Lambda}$ is the factor loadings matrix, $\underline{f}$ is the unobservable common factors, and $\underline{e}$ is the unobservable unique factors (Dillon and Goldstein, 1984:61).

The common variance for the i^{th} original variable is called the communality. It is computed as the sum of the squared elements in row i of the factor loadings matrix and can be interpreted as the percent of total variance shared

by other variables (as opposed to the unique variance) (Dillon and Goldstein, 1984:67). The principal factor method is used to extract the unobserved factors. The mathematics are similar to principal components analysis except the variables' communalities are placed on the diagonals of the correlation matrix (Dillon and Goldstein, 1984:73).

Factor scores are similar in interpretation to principal component scores and give the common factor space location for the observations (Dillon and Goldstein, 1984: 96). The scores are calculated using regression analysis on the products of the standardized data matrix, correlation matrix and factor loadings matrix (Dillon and Goldstein, 1984:97).

One use of common factor analysis is exploratory data analysis where underlying structures and interpretability are the major concerns. Interpretability of factor loadings, factor scores and plots can be greatly enhanced by rotation of the common factors axes. The most common orthogonal or rigid axis rotation, called varimax rotation, maximizes variation of the squared factor loadings within a factor (Bauer, 59).

Summary

This literature review has introduced some of the key concepts of and relationships between business cycles and economic indicators in market economies. It has also

provided technical information on several statistical analysis techniques. Some of the information may be classified as generally useful for background information (specifically the business cycle, economic indicator and Newton-Raphson approximation research). Other information such as some aspects of probit/logit and may be potentially useful. The remaining information is a critical part of the methodology and useful to interpret model results.

III. Methodology

Introduction

The complex nature of this problem dictates a considerable amount of effort in the exploratory or problem definition phase. There is no standard way nor precedence on how to best solve this type of problem. The major steps in the methodology include selecting representative nations to study, collecting appropriate economic data, defining and collecting a measure of stability, determining statistically significant lead/lag relationships between the economic series and the stability measure, and modeling stability as a function of the economic time series.

Country Selection

As mentioned in Chapter I, Country A and Country B were selected on the basis of both data availability and instability patterns. Country A has a recent history of politically unstable events to include civil wars, riots, insurgent operations and military coups. A priori, it appears the instabilities are more a cause of political and social events rather than by economic conditions (which have been fairly stable in the periods of interest). Country B is a more mature third world nation that has also been relatively economically stable in the time frame for the analysis. The periods of instability appear to be economically driven based on CIA reports. A hypothesis of

this research is the more mature nations will experience instabilities more often as a result of economic pressures than their immature counterparts. These less mature nations will have less rational actors and have instabilities caused from a broader range of sources.

Data

The data requirements for both the classification analysis and causal modeling include the quarterly economic time series and the level of stability for each nation. Some of the economic data for less-developed nations is lagged up to a year before it is reported in any source, which takes away from the timeliness of the model. These series are omitted from consideration despite the important economic processes they may measure. This delay is in sharp contrast to Stafford Beer's work with the Chilean economy where he set up a "nervous system" of on-line economic information to give the national leaders real time control for an early warning of economic crises (Beer, 1975:430).

Economic Time Series. Most developing nations do not report economic data as bountifully or as frequently as the U.S., thus methodologies paralleling efforts for the U.S. economy are largely inapplicable. The relative importance of a particular economic series in one developing nation cannot necessarily be expected to be equally important for any other developing nation.

These economic series are the independent variables and should include enough information to account for the major economic activity within a nation. Some examples of major economic activity indicators include inflation and interest rates, imports and exports, industrial production, agricultural indices, commodity prices, employment rates, major banking institutions' financial status, currency exchange rate, money, or reserves. Some of this data is available monthly and quarterly in the International Monetary Fund's (IMF) monthly publication International Financial Statistics. All other major sources found do not have monthly or quarterly data on relevant economic processes. A classified appendix to this study contains the economic data for both countries. Tables 2 and 3 identify the economic data by independent variable names (X1, X2...) used in the models along with a brief description of the series for Country A and B respectively.

Table 2. Country A Economic Time Series

X1	= Exchange Rate - national currency per SDR (weighted sum of five leading currencies)
X2	= Use of International Monetary Fund (IMF) credit
X3	= Total reserve holdings minus gold
X4	= Monetary Authorities (MA) claims on government
X5	= MA claims on the private sector
X6	= MA reserve money
X7	= MA balance of payments (assets - liabilities)
X8	= MA capital accounts
X9	= MA long term foreign borrowing
X10	= Deposit Money Banks (DMB) reserve money
X11	= DMB balance of payments
X12	= DMB mortgage bonds
X13	= DMB time, savings and foreign currency deposits
X14	= Monetary Survey (sum of DMB and MA) net foreign assets
X15	= Monetary Survey (MS) domestic credit
X16	= MS claims on government
X17	= MS claims on the private sector
X18	= MS money (known as M1)
X19	= MS foreign borrowing
X20	= Consumer price index standardized for an average basket of goods and services (1980 = 100)
X21	= Balance of trade (exports minus imports)
X22	= Ratio of major export product to total exports
X23	= Government revenue minus expenditure
X24	= Ratio of foreign debt to the sum of foreign and domestic debt

Table 3. Country B Economic Time Series

X1	=	Exchange rate - national currency per SDR (weighted sum of five leading currencies)
X2	=	Use of International Monetary Fund credit
X3	=	Total reserve holdings minus gold
X4	=	Current balance of payments (assets - liabilities) for Deposit Money Banks (DMB)
X5	=	Current balance of payments for the Monetary Authorities (MA)
X6	=	Current claims on government accounts by the MA
X7	=	MA reserve money
X8	=	DMB total reserves
X9	=	DMB claims on the private sector
X10	=	DMB claims on the government
X11	=	DMB foreign liabilities
X12	=	Residents' time, savings and foreign currency deposits into DMBs.
X13	=	DMB capital accounts
X14	=	Monetary Survey (sum of DMBs and Monetary Authorities) domestic credit
X15	=	Monetary Survey (MS) claims on government
X16	=	MS claims on private sector
X17	=	MS Money (known as M1)
X18	=	Quasi Money - MS holdings of residents' time, savings and foreign currency deposits (the sum of Quasi Money and Money is known as M2)
X19	=	MS foreign borrowing
X20	=	Long term foreign liabilities by other banking institutions
X21	=	Financial Survey (consolidation of other financial institutions and Monetary Survey) domestic credit
X22	=	Financial Survey (FS) liquid liability
X23	=	FS long term foreign borrowing
X24	=	Current interest rate on treasury bills
X25	=	Consumer price index standardized for an average basket of goods (1980 = 100)
X26	=	Percent of total exports accounted for by the major export product
X27	=	Balance of trade (exports - imports) (US $mil)

Also contained in the classified appendix are the values for the series as the percent change from the previous period. This relative change value takes out the trend and scaling effects and is computed by the formula

Delta X = $(X_t - X_{t-1})/X_{t-1}$. Often it is magnitude of this relative change that determines the general population's perception of economic stability. For example, an inflation rate of 20% may be tolerable in a nation, but if it were 10% in the previous period, the 100% increase may be perceived as intolerable.

Significant problems with the IMF economic data include lack of consistency in the values reported from one volume to the next, change of consumer price indices baseline year from 1975 to 1980 and then to 1985, and the termination of several important economic series after a certain date.

Stability Index. The response of these causal models is an aggregate index of stability. Some other stability indices could be number of strikes, riots, or demonstrations. There is no known or accepted source for an aggregate stability index, but the Central Intelligence Agency puts out periodic information assessing political instability with several categories of data rated on a subjective scale from negligible to serious concern. Table 4 shows the format of the six major headings and the associated sub-headings of this information.

An aggregate stability index for these nations was reported by the CIA for 20 of the 36 or 38 periods (Jenkins, 1989). The index for the other periods was estimated using values reported in Table 4 for each quarter. The stability

Table 4. Categories of Instability (Jenkins, 1989)

SOCIAL CHANGE/CONFLICT	Ethnic/Religious Discontent Demonstrations/Riots/Strikes
ECONOMIC FACTORS	General Deterioration Decreased Access to Foreign Funds Capital Flight Unpopular Changes in Economic Policies Food/Energy Shortages Inflation
OPPOSITION ACTIVITIES	Organizational Capabilities Opposition Conspiracy/Planning Terrorism and Sabotage Insurgent Armed Attacks Public Support
MILITARY ATTITUDES/ACTIVITIES	Threat to Corporate Interests Discontent Over Career Loss/Pay/Benefits Discontent Over Govt Action/Policies Reports/Rumors of Coup Plotting
EXTERNAL FACTORS	External Support for Government External Support for Opposition Threat of Military Conflict
REGIME ACTIONS/CAPABILITIES	Repression/Brutality Security Capabilities Political Disunity/Loss of Confidence Loss of Legitimacy

* Each category is rated quarterly as negligible, low, moderate, substantial, or serious concern.

index for Country A and Country B is contained in the classified appendix. Appendix A contains a set of questions CIA analysts are furnished for assigning the subjective ratings for political instability. The appendix is included to demonstrate the comprehensiveness of the CIA's rating and to justify its use as an aggregate measure of stability.

Independent Variable Selection

Many of the economic series for each country are highly related to other series. This correlation may be caused by one series being a broader measure of the same information. An example of this could be the Monetary Survey economic series versus the Monetary Authorities economic series. The series may also move closely together for other reasons. The simple correlation coefficient is a measure of this relationship and can be used to limit the size of the independent variable set. The information from one series can be used as a surrogate for one or more other series thus limiting the analysis and number of calculations required while losing little information. The simple correlation coefficient of the economic series and the stability index may also show useful relationships.

Models

The twofold research objective of classifying economic time series in a lead/lag relationship with stability and developing a causal model requires two distinct formulations described below.

Economic Time Series Classification.

The classification of economic series as leading, lagging or roughly coincident is done by looking at the cross-correlation plot and a time series plot of the stability index and the relative change of the economic series.

Cross-Correlation Analysis. The cross-correlation plot shows the relationship between the response and an economic series for lags between -9 and +9 periods. The cross-correlation coefficients at the various lags are computed the same as simple correlation coefficients only with the data lagged for the appropriate number of periods.

If the economic series is a leading indicator of instability, then significant spikes may appear at lag -2 and -1. Figure 3 below illustrates the concept of coincident indicators with a cross-correlation plot of monthly percentage change in both U.S. industrial production and gross national product (GNP) from 1971 to 1986. The industrial production index is a coincidental indicator of the aggregate measure of the economy (GNP) based on the correlation coefficients from -2 to 3 being significantly higher than at other lags. If the industrial production index were a leading indicator, then the correlation coefficients might have been significantly higher at lags -5 to -1.

Graphical Analysis. Graphical analysis may also be used to visualize relationships between the stability index and the economic time series. An example of this is shown in Figure 4 with monthly percentage changes in U.S. housing starts versus GNP from 1971 to 1986. GNP percent

```
          CROSS CORRELATION OF GNP AND IND PROD

              -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG  CORR.      +----+----+----+----+----+----+----+
-9   0.006                     *
-8   0.007                     *
-7  -0.041                    **
-6  -0.030                    **
-5   0.025                     **
-4   0.085                     ***
-3   0.201                     ******
-2   0.301                     *********
-1   0.475                     *************
 0   0.522                     **************
 1   0.526                     **************
 2   0.438                     ************
 3   0.305                     *********
 4   0.232                     *******
 5   0.156                     *****
 6   0.190                     ******
 7   0.164                     *****
 8   0.169                     *****
 9   0.169                     *****
```

Figure 3. Cross-Correlation Plot of GNP and Industrial Production [9]

change is the top series and is multiplied by 25 for scaling purposes. The scale on the X axis is months starting with January 1971 as period 1.

It is clear housing starts leads GNP particularly in the rapid growth near period 50, the rapid decline near period 110, and the entire cycle from period 150 to the end.

The stability index for this research ranges in integer values from 0 to 4 so the continuous economic indicator series are not as likely to follow as closely a pattern to stability as housing starts does to GNP. This graphical

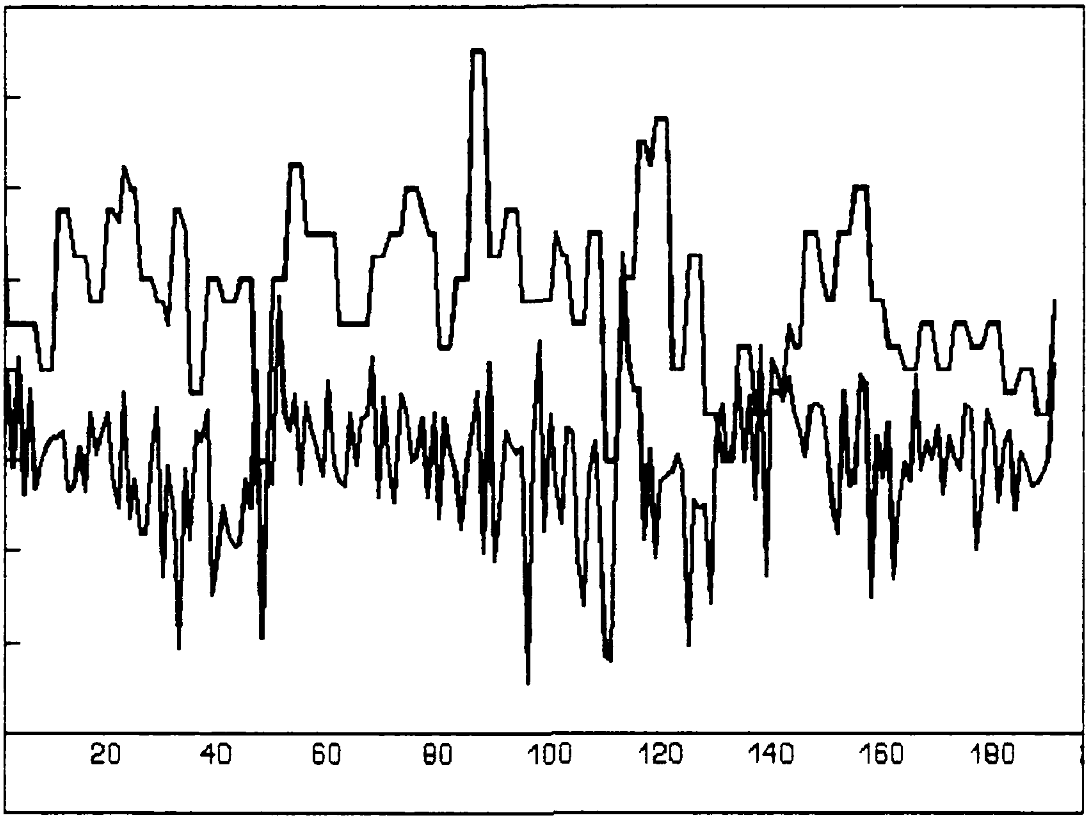

Figure 4. Time Series Plot of U.S. Monthly Housing Starts (bottom) and GNP (top)

analysis is a pattern recognition exercise and may not be as clear with the discrete stability index.

<u>Causal Models</u>. The approach is to first determine if any significant lead/lag relationships exist from the classification stage. If there are valid relationships, then this information can be incorporated in the predictive models. The regression models include principal components regression and OLS regression using the relative change series for each nation.

<u>Principal Components Regression Analysis</u>. The first step is to see if there exists a linear combination of

a subset of the independent variables with a statistically significant causal relationship with the stability index. Principal components regression is done by first transforming the raw (as opposed to relative change) values of the sixteen independent variables into sixteen orthogonal eigenvectors. The correlation matrix is used to compute the eigenvectors because of the nonstandard units between the series. Principal component scores can then be computed from the original mean corrected data and the associated eigenvectors. These scores can then be regressed against the response variable. The subset of significant principal components for the regression is chosen using a stepwise regression procedure which maximizes the adjusted R^2.

<u>OLS Regression Analysis</u>. OLS regression is done by regressing the full set of relative change variables on the response. The "best" model is initially identified using stepwise regression. The variance-covariance matrix and residuals are closely examined for multicollinearity, heteroschedasticity, and autocorrelation diagnostics. It is possible no significant relationships will emerge from the principal components or OLS regression analysis and the use of more sophisticated regression models may be deemed inappropriate.

<u>Probit/Logit Model</u>. A proper functional form of a causal relationship mapping a probability of instability from a given set of economic series is the probit/logit

model. Due to software limitations, this regression-based technique requires a binary coding scheme of "0" for stable and "1" for instable. The recoding is done subjectively based on the CIA information and is reported in the classified appendix.

There are three general probit/logit model formulations based on the form of the independent variable set $\underline{X}$. The first, called the limited quantile model, computes aggregate economic stability (S) and instability (I) indices from the four or five economic time series identified as most significant in the OLS regression analysis. The economic stability index calculation begins by selecting the top 10-20% (4 to 7) quarters within each economic series where the relative change values intuitively lead toward stability (for example increasing reserves or decreasing interest rates). Next, each quarter's economic stability value S is determined by summing across the variables those selected in the top quantiles. The economic instability index I is calculated the same way except the relative change values should lead toward instability.

A simplified example of this formulation is shown in Table 5. Intuitively, increases in X2 (Balance of Trade)

Table 5. Example of Quantile Model Formulation

Period	X1	X2	X3	I	S
1	.21	-.31	-.11	0	0
2	-.12	.12	-.72**	1	0
3	.93**	-.63**	.33	2	0
4	-.14	.54	.24	0	0
5	-.45*	.13	-.71**	1	1
6	.16	-.32	.22	0	0
7	.77**	-.71**	-.13	2	0
8	.29	.92*	1.24*	0	2
9	-.58*	.43	.62*	0	2
10	.30	.14	-.31	0	0

and X3 (Reserves) and a decrease in X1 (inflation) would lead toward stability. The relative change values with one asterisk (*) in the table indicate periods in the top 10-20% quantile for the economic stability index S. Similarly, the periods with two asterisks (**) are in the top 10-20% quantiles for the economic instability index I. The values for each period's S and I index are found by just summing across the rows the number of single asterisks for S and double asterisks for I. The full quantile model is also formulated the same way except all sixteen economic series are used.

The relative change model takes the significant series from the OLS regression and standardizes the values so that the lowest value is 1.0 in each series since probit/logit models accept only positive integers as independent variables. The standardization is accomplished by multiplying each relative value by 100 and adding the

absolute value of largest negative value plus one to each entry in the series.

Several runs for each model are made to include lagged variables and different variable combinations. No more than three lag periods are used based on the graphical and cross-correlation plots and the lack of observations. The observed versus expected responses along with the Chi-Square, p, and t values are used to judge the model adequacy.

Multivariate Techniques

There are several multivariate exploratory data analysis techniques. Cluster analysis is used for grouping observations with similar structure. It may also be used to group similar variables. Factor analysis is an extension of principal components analysis and seeks to define the true dimensionality of the independent variable space.

Cluster Analysis. Cluster analysis is performed on the economic time series to group observations by quarter. These clusters can be compared to the stability index to see if any relationships exist. If a solid relationship with stability is found within a cluster, prediction of stability levels for new sets of quarterly data may be possible. Cluster analysis is performed using all sixteen of the original and relative change variables and also the significant relative change variables from the OLS regression. Clustering the economic time series variables

and stability index may also provide insight to lead/lag relationships or economic processes within the countries.

Factor Analysis. Common factor analysis is performed on the original and relative change economic time series to determine the structure and dimensionality. The stability index is initially included to see which other variables load heavily on the same factor as stability. The stability index is then excluded to see if the factor loadings have significantly changed. If they have changed, then the factor the stability index originally loaded on is no longer considered to be the "stability" factor and simple plots of the factor scores versus the stability index must be used to determine the new "stability" factor. An ideal plot would be one where periods with a high stability index corresponds to clusters of very high or very low factor scores and the opposite holds true for a low stability index.

The factor loadings give insight to the relative importance of the economic time series to the factor. A varimax rotation is performed to gain further insight to the relationship between the economics and stability.

The factor scores are computed by least squares regression to see if there is a strong association between each observation's score and respective stability index. Plots of the factors scores versus each other may also show insightful relationships.

Summary

This chapter on methodology described the general problem formulation and modeling approach. The economic indicators are classified by cross-correlation plots and graphical analysis and the causal models use regression and multivariate techniques.

IV. Discussion of Results

Introduction

The purpose of this chapter is to present the results from the methodology described in Chapter III. The results are divided into sections based on technique and then further subdivided based on Country A or Country B.

Independent Variable Set Selection

The economic series are assumed to possess a relatively high degree of multicollinearity. The objective of this section is to identify those series highly correlated with one or more other series to limit the size of the independent variable set. The approach is to look at the simple correlation coefficients contained in Appendix B among all the variables and eliminate one (or more) from a pair (or set) of highly correlated variables. A high degree of correlation is assumed to be anything greater than .7. The relative change series were used since the raw series values had almost all correlation coefficients greater than .7. Also included in the correlation analysis is the stability index to show the one to one relationship of the series to the response. The results for each country are described below.

Country A. Monetary Survey (MS) Quasi Money is exactly equal to Deposit Money Bank (DMB) Time, Savings and Foreign Currency Deposits (X13) so Quasi Money is not recorded. DMB

Claims on Government (X4) is eliminated due to a correlation coefficient (CC) of .86 with the broader measure MS Claims on Government (since MS is the sum of Monetary Authorities and DMBs). Monetary Authorities (MA) Reserve Money (X6) is eliminated because of a CC of .7 with DMB Reserve Money (X10). MA Long-Term Foreign Liabilities (X9) is eliminated because of a CC of .99 with MS Foreign Borrowing (X19) and the Ratio of Foreign Debt (X24) is eliminated by being highly correlated with both (CC=.86 and .84 respectively) series (X9 and X19) as well as not having observations for the last several periods. MA Balance of Payments (X7) is also negatively correlated with X9 and X19 (CC=-.82 and -.91) and eliminated. Principal Export Percentage (X22) has a CC of .7 with DMB Balance of Payments (X11) and is eliminated based on this and missing observations. MS Domestic Credit (X15) eliminates both MS Claims on Government (X16) and MS Money (X18) with CCs of .73 and .76 respectively. Thus, eight variables are initially eliminated from Country A's predictor set (X4, X6, X7, X9, X16, X18, X22 and X24) because of high correlation with other variables.

Country B. MA Balance of Payments (X5) is excluded because of a CC of .85 with Total Reserves Minus Gold (X3). The Exchange Rate (X1) has the least lag reporting time of any series and excludes the following five other series due to high correlations: (1) MS Domestic Credit (X14), (2) MS

Claims on Government (X15), (3) Other Banks Long-Term Foreign Liability (X20), (4) Financial Survey (FS) Domestic Credit (X21), and (5) FS Long-Term Foreign Borrowing (X23). MA Reserve Money (X7) is dropped in lieu of DMB Reserve Money (X8) because of a CC of .82 and DMBs accounting for a larger percent of total reserves. MS Claims on Private Sector (X16) is kept rather than DMB Claims on Private Sector (X9) because of a CC equal to .98. DMB Time, Savings and Foreign Currency Deposits (X12) and MS Quasi Money are eliminated because of a high correlation with FS Liquid Liabilities (X22) (CCs of .79 and .85 respectively). DMB Foreign Liabilities is equal (CC=1.0) to MS Foreign Borrowing (X19) and thus eliminated. This initial correlation analysis eliminated 11 predictor variables (X5, X7, X9, X11, X12, X14, X15, X18, X20, X21, X23). Henceforth, only these reduced data sets of sixteen independent variables for each nation will be used in the analysis.

Economic Series Classification

Cross-Correlation Analysis. The cross-correlation plots for the relative change series versus the stability index for both countries are included as Appendix C. Table 6 and Table 7 give a summary of the lead/lag relationships, the duration (number of lag periods), and the mean cross-correlation coefficient throughout the duration.

A series is assumed to have significant correlation if the absolute value of the cross-correlation coefficient is greater than .25 and the number of lags is not greater than ±4 lags from 0 before the relationship began. Also series with inconsistent positive and negative signs for the correlation coefficients are less significant than those where the sign remains constant for all lags.

Table 6. Cross-Correlation Summary- Country A

Variable	Relationship	Lag Periods	Corr Coef
X1	inconclusive		
X2	inconclusive		
X3	lead	-3	.3
X5	inconclusive		
X8	inconclusive		
X10	inconclusive		
X11	lead	-6 to -4	-.25
X12	lead	-1	-.25
X13	inconclusive		
X14	lag	4 to 10	.3
X15	lag	1	.3
X17	inconclusive		
X19	lag	3 to 6	-.25
X20	inconclusive		
X21	coincident	0 to 1	-.3
X23	lag	2 to 8	-.3

Table 7. Cross-Correlation Summary- Country B

Variable	Relationship	Lag Periods	Corr Coef
X1	lead	-3 to -1	.3
X2	leads at -11 to -6	lags at 6 to 11	.3, -.4
X3	inconclusive		
X4	coincident	-6 to 6	-.3
X6	inconclusive		
X8	lag	2 to 5	.3
X10	inconclusive		
X13	coincident	-6 to 9	.5
X16	leads at -4 to -2	lags at 2 to 10	.3, .4
X17	lead	-2	.3
X19	lag	3	-.3
X22	inconclusive		
X24	inconclusive		
X25	lead	-3 to -1	.5
X26	lead	-1	-.5
X27	inconclusive		

Several of the variables are inconclusive in both countries because they do not have cross-correlation coefficients greater than .25 with the possible exception of a few scattered periods at high lag periods. There appear to be no dominating lead/lag relationships in Country A, but a few marginally significant ones worth pursuing. In Country B, the variables that appear to have the strongest relationship with the stability index are X13, X25 and X26.

Although not included in Appendix C, the cross-correlation plots of the principal component scores versus the stability index show generally larger spikes. Country A has cross-correlation coefficients of ± .4 or greater for the first, third, seventh, ninth, tenth, and eleventh principal components at many lags. Country B has cross-

correlation coefficients of ± .5 or greater for the first four principal components.

Graphical Analysis. The classified appendix contains the time series plots for both countries of the relative change of the sixteen economic series versus the stability index. Tables 8 and 9 summarize the graphical results for the two countries. The tables give the expected correlation (positive or negative) between stability and the series, the apparent graphical relationship (lead/lag), the approximate number of periods the relationship lasts, and a subjective rating. This rating describes how well the series matches the pattern of the stability index. No series follows the index exactly, but some have fewer deviations and pick up periods of transitions better than others.

Table 8. Graphical Analysis Summary- Country A

Variable	Corr	Relationship	Length	Rating
X1	pos	lead	1-2	good
X2	pos	lag	3-4	good
X3	neg	coincident		fair
X5	pos	lead	2-3	fair
X8	neg	lead	1-2	good
X10	no	significant	relationship	
X11	neg	lead	1-3	fair
X12	neg	lag	1-2	fair
X13	neg	lead	2-3	fair
X14	neg	coincident		good
X15	pos	lead	1-2	good
X17	pos	coincident		fair
X19	pos	lag	2-3	fair
X20	pos	lag	2-3	good
X21	neg	coincident		good
X23	neg	lead	1-2	fair

The graphical representation shows the lead/lag relationships better than the cross-correlation analysis for Country A. Agreement between the two techniques for Country A is limited to identifying X11 as leading and X19 as lagging. X12, X15, and X23 were classified directly opposite (one leads the other lags) by the two techniques.

Table 9. Graphical Analysis Summary- Country B

Variable	Corr	Relationship	Length	Rating
X1	pos	coincident		good
X2	pos	no significant relationship		
X3	neg	coincident		good
X4	neg	lead	1-2	fair
X6	pos	coincident		good
X8	neg	coincident		fair
X10	pos	no significant relationship		
X13	neg	no significant relationship		
X16	pos	no significant relationship		
X17	neg	lead	1-2	fair
X19	pos	lag	1-2	good
X22	pos	no significant relationship		
X24	pos	coincident		good
X25	pos	lead	1-2	good
X26	neg	coincident		fair
X27	neg	coincident		fair

The two techniques again yield different results for the lead/lag relationships for Country B. Both however, do indicate X17 and X25 as significant leading indicators and X19 as a significant lagging indicator.

Regression Analysis

The multiple regression analysis is with both the principal components of the raw economic series and the

relative change values regressed separately against the stability index to see if any variable combination exhibits a statistically significant causal relationship. The results of the specific models for each country are shown in separate subsections to follow.

Many aspects of the regression analysis are common to all models. Residual analysis is used to test model aptness. All of the residual scatterplots are centered on 0, 1, 2, or 3 for the X axis (fitted values) and half above 0 and half below 0 for the Y axis (standardized residuals) with few exceeding two standard deviations. A typical residual plot is shown in Figure 5. The residuals appear to be on a vertical diagonal line because the response variable is discrete. If the fitted value is less than the actual, then the residual will necessarily be positive by definition and the opposite holds true if the fitted value is greater than the observed. The Durbin-Watson test statistic derived from the residuals is analyzed to detect serial autocorrelation in the time series. Also, all of the models have Wilk-Shapiro p-values greater than .95 which indicates a normal distribution for the residuals.

```
Std Res
   3.0 +
       :
       :                              +
       :  +           +              2
       :                +
   1.0 +                +             ++
       :   2             3+
       :    2             3+            +
     0 :- - -2- - - - - - -3- - - - - - - - - - -
       :                    3
  -1.0 +      +                           +
       :        2             2             +
       :                       +
       :
       :
  -3.0 +
       -+---------+---------+---------+---------+-
      -0.3       0.4       1.1       1.8       2.5
                       Fitted Values
```

Figure 5. Typical Residual Plot from Regression Models

The results from the previous lead/lag analysis are incorporated by using lagged variables in the models. This results in additional missing cases, which, in some cases, outweighs the benefit of lagging these variables. The independent variable set for Country A includes X1, X5, X8, and X11 lagged two periods (since they are leading indicators), X19 and X20 not lagged (since they are lagging indicators) and all other variables lagged one period. Similarly for Country B, X4, X5, X17, X25 and X26 are lagged two periods, X19 not lagged at all, and all other variables lagged 1 period. Higher lags are not included because initial analysis showed them to add no significance in any

regression model and the additional missing cases are not desirable.

Country A Principal Components Regression. This analysis excludes variables X21 and X23 from the set of sixteen because of several missing values. The cumulative percent of variance explained by principal components, eigenvalues, eigenvectors and component scores are all given in Appendix D.

Regressing all fourteen principal components on the stability index yields an R^2 of .76, but the model has highly insignificant t values for many of the coefficients. The best parsimonious model results obtained from a stepwise regression routine are shown in Table 10. The entry and exit criteria for the stepwise procedure are set at a p-value of .15.

The Wilk-Shapiro p-value of .98 suggests a normal distribution for the standardized residuals and the plot of these residuals versus the fitted values shows no major problem areas (heteroschedasticity or other suspect patterns). There is no significant positive or negative autocorrelation in the residuals as indicated by the Durbin-Watson statistic of 1.76. Comparing the fitted values versus the actual stability index shows the model does well in predicting the values of the quarters with a change in the stability index from the previous period in period 22 to

36, but is marginal in the first 21. Thus, the model is apt and mildly statistically significant.

Table 10. Principal Components Regression Results-
Country A

Unweighted Least Squares Linear Regression of Y

Independent Variables	Coefficient	Std Error	Student's T	P
Constant	1.9444	8.8531E-02	21.96	0.0000
P1	-1.1286E-01	2.8452E-02	-3.97	0.0004
P2	1.3571E-01	5.6566E-02	2.40	0.0231
P3	-5.1744E-01	1.1706E-01	-4.42	0.0001
P6	5.8942E-01	2.7045E-01	2.18	0.0376
P13	-3.1317	1.4479	-2.16	0.0389
P14	-4.5684	2.0022	-2.28	0.0300

Cases Included	36	Missing Cases	0
Degrees of Freedom	29		
Overall F	9.277	P Value	0.0000
Adjusted R Squared	0.5866		
R Squared	0.6575		
Resid. Mean Square	2.822E-01		

The significant outlying variables based on principal component loadings for the six principal components in the previous regression may also be significant in the OLS regression. The eigenvectors reported in Appendix D are directly proportional to the principal component loadings. The outliers shown in Table 11 are based on the variables having significantly higher loadings (usually anything greater than .5) than other variables on the same principal component/factor.

Table 11. Outlying Variables Based on Component Loadings - Country A

Principal Component	Outlying Variables
P1	NONE
P2	X2, X5, X12
P3	X5
P6	X12
P13	X17
P14	X13

It appears X5 and X12 are significant economic indicators in this regression model based on p-values of the principal component scores and the associated component loadings. A priori, X5 and X12 should be significant variables in the OLS regression.

A principal component regression is also attempted on the relative change values, but the results are considerably worse than using the original variables. Principal component regression using the lead/lag relationships also proves to be no better and overall not beneficial in light of losing additional quarters of data.

Country A OLS Regression with Relative Values. Instabilities may be caused by the population or interest groups perceiving the relative change of a series as an economic crisis. Regressing the stability index on the relative change in the sixteen economic series of Country A shows a poor causal relationship with only five individual variables having a p-value less than .1. A stepwise regression routine does not enter any variable in this model

even by considerably relaxing the entry parameter to a p-value of .4. The "best" model is therefore considered to be one with the four variables with significant individual p-values at the 90% level. The results are shown in Table 12.

Table 12. OLS Regression Results- Country A

Unweighted Least Squares Linear Regression of Y

Independent Variables	Coefficient	Std Error	Student's T	P
Constant	1.6411	1.3642E-01	12.03	0.0000
LAG1X1	7.5158	3.3477	2.25	0.0335
X5	3.9803E-01	1.9051E-01	2.09	0.0466
X12	4.6721	1.8733	2.49	0.0193
X21	-5.5097E-02	3.1191E-02	-1.77	0.0891

Cases Included	31	Missing Cases	5
Degrees of Freedom	26		
Overall F	3.798	P Value	0.0146
Adjusted R Squared	0.2717		
R Squared	0.3688		
Resid. Mean Square	4.417E-01		

This model is not as powerful as the principal component regression and does have unsatisfactory to marginal R^2, p, and F values. The residual analysis concludes the model aptness is questionable based on the large variances in the plot of the standardized residuals and fitted values. The key result is both X5 and X12 turned out to be significant using the relative values as well as the original values transformed through the principal components.

Country B Principal Components Regression. The cumulative percent of variance explained, eigenvalues, eigenvectors, and component scores for the principal component analysis for the reduced set of raw economic time series are listed in Appendix D. Regressing all sixteen principal components on the stability index produces an R^2 of .96 with all but five principal components having highly significant p-values. Many models using five or fewer principal components yield R^2 values greater than .85, but all have significant problems with negative autocorrelation in the residuals which suggests more independent variables are required. The final model to correct for the autocorrelation problem is shown in Table 13.

The Durbin-Watson statistic for autocorrelation was 2.17 which concludes no significant negative or positive autocorrelation. The residuals are normally distributed with a Wilk-Shapiro value of .97. The variance-covariance matrix is not reported since each principal component is orthogonal to all others, thus having essentially zero for all covariances.

The significant outlying variables based on component loadings for the ten principal components in the previous regression may also be significant in the OLS regression.

Table 13. Principal Component Regression Results- Country B

Unweighted Least Squares Linear Regression of Y

Independent Variables	Coefficient	Std Error	Student's T	P
Constant	1.0000	3.1300E-02	31.95	0.0000
P1	1.1069E-01	9.2741E-03	11.94	0.0000
P2	7.9832E-02	2.1244E-02	3.76	0.0008
P3	3.4572E-01	3.2432E-02	10.66	0.0000
P5	3.7149E-01	5.9380E-02	6.26	0.0000
P6	-2.2328E-01	7.5646E-02	-2.95	0.0065
P7	-0.9704	1.1469E-01	-8.46	0.0000
P9	7.4838E-01	2.2707E-01	3.30	0.0027
P10	2.0887	3.8367E-01	5.44	0.0000
P15	-4.3284	1.2342	-3.51	0.0016
P16	-7.6770	2.0475	-3.75	0.0009

Cases Included	38	Missing Cases	0
Degrees of Freedom	27		
Overall F	45.65	P Value	0.0000
Adjusted R Squared	0.9235		
R Squared	0.9442		
Resid. Mean Square	3.723E-02		

The eigenvectors reported in Appendix D are directly proportional to the principal component loadings and were used to extract the outliers when the loading exceeds .45 in absolute value. Table 14 shows the outlying variables.

The incorporation of the lead/lag relationships from the classification stage leads to slightly worse results and are not included because of the generation of missing cases.

Table 14. Outlying Variables Based on Component Loadings-Country B

Principal Component	Outlying Variables
P1	NONE
P2	X24, X27
P3	X4
P5	X2
P6	X10, X26
P7	X26
P9	X3, X22
P10	X25
P15	X1
P16	X13, X25

Country B OLS Regression with Relative Change Values. The most promising model without using principal components or other complex multivariate techniques is the relative values, with the incorporation of the lag relationships, of Country B versus the stability index . The results from the model using stepwise regression are shown in Table 15.

The results of the residual analysis are a Durbin-Watson value of 1.6, a Wilk-Shapiro p-value of .98, and no problems with the plot of fitted versus standardized residuals. Other models have higher R^2 values, but also a high degree of collinearity in the independent variables. The variance-covariance matrix for the final model is shown in Table 16.

Table 15. OLS Regression Results- Country B

Unweighted Least Squares Linear Regression of Y

Independent Variables	Coefficient	Std Error	Student's T	P
Constant	8.4281E-01	1.5518E-01	5.43	0.0000
X4	-1.4807	5.5438E-01	-2.67	0.0119
X8	-1.5651	5.3668E-01	-2.92	0.0065
X22	-2.902	6.8877E-01	-4.21	0.0002
LAG1X25	4.7464	1.0000	4.75	0.0000
X26	-2.4330	7.8737E-01	-3.09	0.0042

Cases Included	37	Missing Cases	1
Degrees of Freedom	31		
Overall F	11.97	P Value	0.0000
Adjusted R Squared	0.6037		
R Squared	0.6588		
Resid. Mean Square	1.868E-01		

Table 16. Variance-Covariance Matrix- OLS Country B

Variance - Covariance Matrix for Coefficients

	Constant	X4	X8	X22	LAG1X25	X26
Const	.0241					
X4	-.0206	.3073				
X8	-.0139	-.0013	.2880			
X22	-.0196	.0246	.0183	.4744		
LAG1X25	-.1051	.1020	-.0855	-.2700	1.0000	
X26	-.0206	.0320	-.0214	.0159	.1771	.6200

From the cross-correlation plots it was determined X13 had a highly significant relationship with the stability index. The p-value for X13 in this model was .6 indicating it was not significant in this regression. This suggests the best linear combination of a subset of independent variables is not always determined by those individual

variables with the single highest correlation with the response.

Probit/Logit Model

The overall probit/logit model results are disappointing after the promising causal relationships identified from both the OLS and principal component regressions. The selected software packages are unable to accommodate the multinomial models unless in contingency table format, so only dichotomous (0, 1) response models are run. The recoding of the stability index is accomplished by making 1's the "instable" and 0's the "stable" periods. This binary coding is shown in the classified appendix.

The three general probit/logit models for each country are the limited quantile, full quantile and relative change models as discussed and developed in Chapter III. Every run of these three model forms for both countries shows there to be negligible difference between the probit and logit model estimations, thus only the logit models are reported. The logit functional form is $[\log(p/(1-p))/2 + 5) = \beta_0 + \beta X$ where p is the probability of an unstable period. All models have highly significant t values for the intercept term and this term is subsequently not mentioned.

The results for each country are discussed below and the relevant model output is in a classified appendix to this research. Good models will have high p-values, low

Chi-Square Goodness-of-Fit values and t values on the individual coefficients greater than 2.0 in absolute value.

Country A. The results for Country A were not encouraging. A solid causal relationship is not available even after multiple runs at various lags and variable inclusions of the three general models.

Limited Quantile Model. Virtually all of the limited quantile models run with different combinations of variables and lags have the same results: p-values in the .33 range, t values for the economic stability index S and the economic instability index I in the 1.0 to 1.5 range, and Chi-Squares around 35.0. The fitted values show little consistency when compared to the actual response and the residuals for each observation are high. All of these statistics indicate a poor model. The selected model is the aggregate stability index (R) equal to the lag 1 of the economic stability index (S) and the lag 1 of the economic instability index (I).

Quantile Model. The quantile model with all 16 independent variables included is R equal to the lag 2 of both S and I. The p-value is .54, the t values -1.1 and -1.0 respectively, and the Chi-Square 29.5. The fitted values versus the observed are still questionable, but slightly better than the limited quantile model.

The major problem with this and all other runs of this general form is the negative coefficient on I. Logically,

the probability of an unstable period (R = 1) should be greater the larger the value of I; however, none of the runs report a positive value.

Relative Value Model. The selected relative value model is R equal to lag 2 of X1 with a p-value of .38, t value of 1.8, Chi-Square of 34.9, and large residuals once again. The model does pick up some of the transitions of R = 0 to R = 1 or vice-versa but has many high probabilities of instability during stable times. Thus, all of the logit model functional forms and runs for Country A do not provide a solid estimate of the probability of instability given the set of economic inputs.

Country B. The results for Country B do not reenforce the strong causal model derived from principal components or OLS regressions. None of the statistics for the runs indicate highly significant probit/logit models.

Limited Quantile Model. The best limited quantile run for Country B is R equal to lag 1 of I. The p-value is .38, the t value 1.12, and the Chi-Square 36.9. The fitted values miss most of the transitions and never exceed a value of .365.

Quantile Model. Surprisingly, the best model with the full quantile model shows the economics as lagging indicators of the stability index. The model is lag 1 R is equal to S and I. The p-value is .57, the t values -1.5 and 1.5 respectively, and the Chi-Square 31.9. The fitted

values also do not seem to follow the instability index very well.

The greatest expected probability of instability occurs when $S = 0$ and $I \geq 3$. These combinations have higher expected probabilities (fitted values) than the worst intuitive stability combination when $S = 3$ and $I = 8$. It appears the economic stability index S exerts greater influence on the probability of instability than the economic instability index I.

Relative Value Model. The best relative value logit model is R equal to X8, X22 and lag 1 of X25. The p-value is .71, t values are -1.25, -1.43 and 1.8 respectively, the Chi-Square is 27.2 and the fitted values detect many of the transitions. The variance-covariance matrix offers no suspicion of multicollinearity problems.

The signs of t values are consistent with intuition. An increase in DMB Total Reserves (X8) and FS Liquid Liability (X22) is expected to decrease instability by the negative coefficient and an increase in Consumer Price Index (X25) is expected to increase instability by the positive coefficient.

Multivariate Techniques

Multivariate techniques are used for further exploratory data analysis. Cluster analysis seeks to group the variables and observations with minimum variance within groups and maximum distance between groups. Factor analysis

is used for examining the underlying structure and dimensionality of the data.

Cluster Analysis. The results of the cluster analysis by observation are shown below based on country and variables included in the clustering algorithm. Cluster analysis by variable for both countries shows nothing different from the simple correlation analysis.

Country A. Cluster analysis on all sixteen economic series by observation (where observation 1 is Quarter 1 of 1980) using the original values is highly dependent on the trend and groups them chronologically. Table 17 shows the results for five clusters.

Table 17. Country A Cluster Analysis by Observation with All Sixteen Original Variables

Cluster	Observations
1	1 - 7
2	8 - 19
3	20 - 24
4	25 - 31
5	32 - 36

There appears to be a significant relationship between these clusters and the stability index. Clusters 1 and 3 match with periods of low instability, cluster 2 with high and fluctuating instability, cluster 4 with medium instability and cluster 5 with high instability.

Cluster analysis on all 16 relative change series with six clusters yielded a group of 31 and 5 single

observations. These observations were 2, 7, 18, 22, and 25 which corresponds to generally low levels of instability.

The results from cluster analysis using only the significant relative change variables from the OLS regression (X1, X5, and X12) for 6 clusters are shown in Table 18. There appears to be no significant relationship between the first five clusters and the stability index.

Table 18. Country A Cluster Analysis by Observation on Significant OLS Regression Variables

Cluster	Observations
1	10, 17, 22, 30
2	15, 36
3	14
4	26
5	12
6	All Remaining

Country B. Cluster analysis on all sixteen of the original variables shows chronological grouping similar to Country A. The results for 5 clusters are reported in Table 19 and do not seem to follow the stability index.

Table 19. Country B Cluster Analysis by Observation with All Sixteen Original Variables.

Cluster	Observations
1	1 - 25
2	26 - 29
3	30 - 31
4	32 - 35
5	36 - 38

Table 20 shows the cluster analysis on all sixteen relative change values with one large cluster, a smaller one and five outlying observations for a total of seven clusters. There appears to be no significant relationship between the clusters and the stability index except that clusters 3 through 6 occur in transition periods of the stability from one level to another.

Table 20. Country B Cluster Analysis by Observation on All Sixteen Relative Change Values

Cluster	Observations
1	6, 7, 11, 28, 36
2	2
3	10
4	12
5	13
6	37
7	All Remaining

Table 21 shows the results from cluster analysis on the significant relative change variables from the OLS regression for six clusters. These clusters offer no insight to the stability index.

Table 21. Country B Cluster Analysis by Observation on Significant OLS Regression Variables

Cluster	Observations
1	2, 4, 7, 8
2	1, 36, 37
3	35, 38
4	25
5	33
6	All Remaining

Factor Analysis. Factor analysis is used for exploratory analysis on the data structure and dimensionality. The results from the model runs are reported by country and independent variables used (original, relative change or a subset) in Appendix E. The following sections present a summary of the major findings.

Country A Original Variables. Similar to the principal components analysis, only two factors are required to explain most of the variance based on the eigenvalues of the correlation matrix being greater than 1.0. The factor loadings matrix shows variables X2, X5, X12, and the stability index are heavily loaded on factor 2. X5 and X12 were also significant in the OLS regression completed in a previous section.

The factor scores for factor 2 show observations 14 - 24 have the largest values (.9 to 1.8). The stability index range during this period is generally high with several transitions from one level to another. Similarly, the highly negative factor scores (-.7 to -1.5) group from

observations 1 through 9 which corresponds to a very low stability index throughout the duration.

The varimax rotation adds little new information because the transformation matrix is essentially the identity matrix, but reenforces the initial conclusions of the importance of X2, X5, and X12. Factor analysis on these three variables alone shows identical interpretations except all three variables are loaded on factor 1 which is the only factor to have an eigenvalue greater than 1.0.

Country A Relative Change Values. Seven factors are retained with eigenvalues greater than 1.0. The stability index, X2, X5, and X12 weight heavily on factor 4 which reenforces the results from the previous section of factor analysis on the original variables. All of the communalities are greater than .6 which means there is no variable that cannot be explained decently by a combination of the others.

Factor analysis excluding the stability index retains six factors and significantly changes the factor loadings matrix. The variable communalities also have decreased which implies the stability index contributes meaningfully to the common variance of many variables. Separate plots of the six factor scores versus the stability index provide no further insight to the process. The varimax rotation offers very little additional information.

Varimax rotation and factor analysis on the relative change values for X2, X5, and X12 provide no further relationships to the stability index. The only plot in all of the models that offers insight is the factor 1 scores versus the stability index. This plot (not shown) has all of the scores clustered between -.5 and .5 when the stability index equals 3.

Country B Original Variables. If the stability index is included, three factors are retained by the eigenvalue criteria. The stability index is equally dispersed between factor 1 and factor 3 and has a .82 communality estimate. X4 is the only other variable to load on factor 3. The varimax rotation and factor scores do not add much additional information.

The original values with the stability index excluded show the first factor to have an eigenvalue of 11.7 and a total of three factors with eigenvalues greater than 1.0. The factor loadings matrix shows only X4, X24, and X27 to not load heavily on factor 1. X24 and X27 load on factor 2 and X4 on factor 3. All communality estimates are greater than .8 and the factor scores and plots versus the stability index do not provide any additional insight. The varimax rotation and factor analysis on both the significant OLS regression variables (X4, X8, X22, X25, X26) and the factor 1 outliers (X4, X24, X27) confirm the previous conclusions.

Country B Relative Change Values. Seven factors have eigenvalues greater than 1.0 and the stability index weighs most heavily (.6) on factor 3. X3 and X6 also weigh heavily on factor 3 and all communalities are greater than .6.

If the stability index is omitted, than only six factors have eigenvalues greater than 1.0 and the factor loadings matrix is considerably different from the one with the stability included. Factor 3 is no longer assumed to be the surrogate factor for stability. The plots of the six factor scores versus the stability index show no new relationships and the varimax rotation with associated analysis also adds little insight.

Factor analysis on the significant OLS regression variables (X4, X8, X22, X25, X26) does not add any additional information. The plots of the factor scores versus stability index and the factor scores versus each other are little more than random plots without order.

Chapter V. Conclusions and Recommendations

The purpose of this chapter is to summarize the significant results, discuss limitations and problems, and make recommendations from this research and for further research. The majority of this research effort was in determining and collecting appropriate sources for both the independent and dependent variables for analysis. The research objectives of classifying the economic series as leading, lagging or coincident and causal modeling have been surveyed and empirical results from selected models reported. There is no bottom line saying certain economic series will always lead/lag periods of instability or that a combination of series will be guaranteed to predict a level of instability. This thesis can be viewed in the broader sense as a feasibility study focused on the use of key economic series and their relationship to an aggregate measure of instability. The results indicate that the economic dimension alone is insufficient to handle the indications and warnings process of instability alone. The complex environment requires additional input from other sectors such as political, social, and military.

Summary of Significant Results

The objective of this section is to consolidate the important results that may not have been emphasized enough in Chapter IV's discussion. The simple correlation analysis

highlighted the multicollinearity of the economic time series in both countries and narrowed the independent variable set down to sixteen series for each country. The analysis also showed the correlation of the stability index with any single economic series was negligible. The analysis also demonstrated the strong relationship between the exchange rate in Country B and MS Domestic Credit, MS Claims on Government, FS Domestic Credit, FS Long Term Foreign Borrowing, and Other Banks Long Term Foreign Borrowing.

The classification of the series proved difficult primarily due to the discrete nature of the stability index and the small number of quarters of data. The cross-correlation plots of stability and the economic series showed generally weak relationships with the exception of a few series. Graphical analysis worked better on Country A than B, but both showed many series appear to have relationships to the transitions of the stability index. All of the series had many more transitions than the discrete stability index and could not be identified as reliable indicators of instability. Another insight from classification analysis is the economic time series lagging the stability index may indicate the political instabilities influence the economics rather than the opposite as is assumed.

The initial causal modeling using principal components and OLS regression techniques showed statistically significant models, particularly for Country B. This trend did not continue with the logit model form of mapping a probability of instability from the economic stability and instability indices or the scaled relative values.

Cluster analysis by observation on the original values of the economic series detected the trend component and grouped the observations chronologically. The clusters for Country A appeared to be related to the stability index better than those of Country B. Otherwise cluster analysis generally formed one large cluster with five or six single observations comprising the other clusters. These observations did not have any significant relationship with the stability index. Clustering by variable provided no additional information than the simple correlation analysis.

Factor analysis reenforced the interpretations derived previously from the principal components. Country A had three variables load heavily on the same factor as the stability index using both the original and relative change values. Two of these three variables were highly significant in the OLS regression model. Plots of factor scores versus the stability index and versus other factor scores provided no additional insights for either country.

Conclusions Based on Results

The previous results lead to several conclusions. The first is that there is no combination or single economic series in either country that can be conclusively labeled an "indicator" of unstable conditions. The models and analysis demonstrate there are relationships between this aggregate stability index and the selected economic time series, but there was not enough consistency over all techniques to conclude specific series will always be associated the same way with respect to the instability level.

Another conclusion is the confidence in the techniques and methodology. If there were significant correlations between any response variable and independent variable set, the previous analysis would have properly classified the independent variables and suggested a proper causal model.

The last conclusion concerns the results for each country. The initial hypothesis was that the more developed or mature a third world nation, the greater the economics would influence the instable activities. Rephrased, the hypothesis states the immature nations, with a general less rational behavior pattern, will be influenced greater by social, military or external factors. This appeared to be validated after the initial regression analysis, but did not continue through the logit, cluster, or factor analysis. The hypothesis was not nullified nor proven based on these two nations.

Recommendations.

This research did not identify particular economic series for the analysts at DIA/DB5-E3 to monitor as specific indicators of instability. It did, however, validate the need to continue watching the economic activity within developing nations. There are no policy recommendations, only recommendations for further research.

There are several recommendations for further research ranging from extending the proposed methodology to other nations to exploring other techniques. The analytical techniques used in this research can be rerun with current or pre-1980 (if available) data on Country A and B since the number of observations is so small. Also a comparative analysis can be done using data from other developing nations using the same techniques. Other likely extensions to the proposed methodology include using a different response variable (number of strikes, for example) or expanding the economic series to include other processes (unemployment rates or production indices for example).

The most promising continuation for this research would be in the rapidly expanding field of nonlinear dynamics called chaos. Chaos theory would seek to make order out of the seemingly random economic activity and meaningfully relate it to the stability of the country. Applications could also be found in the field of cybernetics which is concerned with the interaction of control and communication.

Appendix A: Questions for the CIA Analyst of Political Instability

The purpose of this appendix is to list the questions the analysts at CIA use to assess the areas of political instability. The questions cover a broad range of activities and justify the use for the aggregate stability index chosen as the response variable. The questions are broken down by the categories appearing in Table 2 and were furnished by CIA/OAGB/PO.

Social Change/Conflict

Ethnic/Religious Discontent.

1. Is a scapegoat minority or religious community prone to retaliate against violence directed against them?

2. Is the government increasing religious intolerance, suppressing the use of a minority language or culture, or undertaking other policies that change the political, economic, or social status of any group? Are these policies compelling those affected to oppose the government in any way?

3. Are religious leaders increasingly critical of the state of the nation or becoming active in antigovernment activities? Is the general public beginning to support these activities and agree with the criticisms?

4. Are popular movements organized along ethnic, religious, or regional lines growing? Is the public increasingly attracted to these groups?

5. Is separatism a growing issue?

6. Are fundamentalists or other religious groups starting to set up schools in opposition to the public school system, or is enrollment increasing at such schools already in existence?

Demonstrations, Riots, Strikes.

1. Are demonstrations, riots, strikes, or work slowdowns increasing in frequency, scale, scope, and violence?

2. Is greater permissiveness on the part of the government leading to growing unrest?

3. Is increasingly indiscriminate violence by demonstrators resulting in a deterioration of order?

4. Are demonstrations starting to assume a general antiregime tone?

5. Does a demonstration attract a larger crowd than originally predicted? Does a demonstration called by one opposition group attract the genuine--not manipulated--support of other groups not previously involved, such as labor groups in support of student marchers?

6. Are the media becoming more supportive of the demonstrators/rioters and/or ignoring government guidance in their reporting of the incidents?

7. Are elements of the political elite or the security forces beginning to sympathize with the demonstrators/rioters?

8. Are government concessions to the demonstrators or rioters seen as a sign of weakness? Have they failed to calm the unrest?

9. Do strikers have antigovernment political objectives apart from economic motivations?

10. Have workers remained on strike despite government concessions?

Economic Factors

General Deterioration.

1. Is the government losing its ability to generate revenues? Is it finding difficulty in providing public services or maintaining popular subsidies?

2. Is the international economic situation helping to depress the local economy? Is only one sector affected, or is the populace hurting across the board? Does the public blame economic deterioration on the government rather than on other countries or pernicious international forces?

3. Are overpopulation, landlessness, and crop specialization eroding a traditional sector of the economy such as subsistence agriculture and barter, that remains isolated from the modern economic sector and that could provide a safety valve in times of crisis?

4. Have unemployment and underemployment been increasing? Is the education system turning out too many graduates in relation to employment opportunities?

5. Are demonstrations and strikes disrupting any sector of the economy? Do concerned sectors blame the government? Are the disruptions affecting the government's ability to provide goods, services, and patronage? Have concessions to strikers further hurt the economy?

6. Are conditions in the country deteriorating to such an extent that the business sector is expressing doubt about the government's ability to rule?

7. Is the general public blaming the government for the deteriorating economy?

<u>Decreased Access to Foreign Funds</u>.

1. Is the government's ability to obtain foreign aid and investment declining?

2. Is the government losing its ability to supplement national income with remittances from expatriates?

3. Has the government's failure to meet its debt service repayment obligations made creditors unwilling to reschedule all or part of its debt or loan additional money?

<u>Capital Flight/Outflow of Currency</u>.

1. Do the country's reserves or the free market exchange rate reflect capital flight? Does this capital flight result from economic reasons--such as lack of return on investments--or from political fears?

2. Are people taking substantial quantities of hard currency across borders to spend on goods in other countries?

<u>Unpopular Changes in Economic Policies</u>.

1. Are opposing domestic interests discontented over the government's own or IMF-mandated austerity measures?

2. Does the public perceive that the government's economic policies are benefitting only a small segment of the population, such as the elite and associated groups?

3. Conversely, are attempts to redress inequality through taxation, land reform, anticorruption drives, or other economic measures alienating important elements of the elite, such as the military or clergy?

4. Is the business sector hurting from specific government policies? Are losses sufficiently serious to make businessmen increasingly critical of these policies?

Food/Energy Shortages.

1. Have climate or agricultural policies resulted in a reduced harvest? Has the government been unable to obtain food from foreign sources to make up for domestic shortfalls?

2. Are certain elements of the population hoarding food?

3. Has drought led to reductions in hydroelectric power output? Are domestic energy sources nearing exhaustion? Are energy supply lines from outside the country threatened?

4. Is unrest affecting the government's ability to provide food and transportation services?

Inflation.

1. Has the public been frustrated that wages have not kept up with price increases?

2. Is the government increasingly financing its deficit by printing more currency, thereby furthering long-term discontent over inflation?

Opposition Activities

Organizational Capabilities.

1. Are opposition groups increasingly able to mobilize large numbers of people for antiregime activities? Are they organizing to undertake such an action?

2. Are centrists and moderates more and more compelled to choose among radical positions?

3. Does a recognizable, charismatic opposition leader exist to whom the public increasingly is attracted?

Opposition Conspiracy/Planning.

1. Are opposition parties increasingly claiming that the violent overthrow of the government is the only way to bring about change?

2. Are opposition groups coalescing and participating in joint activities? Are labor and student groups forging links with each other and with various opposition groups?

Terrorism and Sabotage.

1. Are terrorist incidents increasing in frequency and intensity? Are they spreading geographically?

2. Are the terrorists or saboteurs attacking government targets?

3. Is terrorism or sabotage deterring any part of the general public from supporting the government?

4. Is terrorism or sabotage hurting key areas of the economy such as energy and transportation?

Insurgent Armed Attacks.

1. Have insurgents increased attacks on government targets? Have they expanded their area of operations?

2. Are rebels gaining popular support through propaganda or coercion?

3. Are insurgents obtaining growing amounts of funding and weaponry?

Public Support.

1. Do increasingly large numbers of the public tend to sympathize with antigovernment demonstrators and strikers?

2. Are the people accepting a specific opposition group as the embodiment of the national identity?

3. Are alienated intellectuals turning toward the opposition and providing it strength?

4. Is a substantial segment of the business sector lending political or financial support to the opposition?

Military Attitudes/Activities

Threat to Corporate Military Interests/Dignity.

1. Are the collective interests of the armed forces being assaulted? Is the government threatening to reduce military autonomy?

2. Is the military upset that some of its members may be punished for human rights abuses, corruption, or other offenses?

3. Have insurgent victories embarrassed the armed forces or hurt military morale? Does the military perceive itself to be in public disrepute?

4. Is factionalism increasing in the military?

Discontent Over Career Loss, Pay, Benefits.

1. Are elements of the armed forces discontented over lack of promotions? Do officers perceive that the government is favoring certain personnel for promotions?

2. Do certain segments of the military fear personnel cuts or disbandings?

3. Is military morale down because of low or late pay? Because of perceived gaps in civil-military wages? Because of reductions in benefits or training opportunities?

Discontent Over Government Actions/Policies.

1. Are military and security services personnel discontented over the government's foreign or domestic policies? Over flagrant government corruption? Are the armed forces hostile to certain civilian leaders?

2. Are the security services unhappy with regime checks over direct power, such as field assignments and divided military structure?

3. Are the armed forces dissatisfied with the state of their equipment? Has the government failed to deliver on promises of equipment?

4. Is the government threatening to cut the military budget because it is a strain on the national economy? Is the government incapable of generating foreign military aid?

Reports/Rumors of Coup Plotting.

1. Have military or opposition officials hinted that they or others may attempt a coup?

2. Has the local media published or broadcast rumors of a coup?

3. Are rumors of coup plotting circulating in the streets and marketplaces?

4. Are antigovernment military personnel establishing ties with like-minded personnel in other grades and services? With like-minded civilians?

External Factors

External Support for the Government.

1. Do the public and influential power groups have negative views of foreign influence and aid that are hurting the government?

2. Are key foreign supporters threatening reductions in political and/or financial support?

3. Is an influx of foreign refugees creating problems for the government?

External Support for Opposition.

1. Is the opposition receiving increased aid from radical foreign sources? Is this improving the recipients' capabilities?

Threat of Military Conflict.

1. Are neighboring countries or other external influences affecting sectarian or regional groups in a way that is eroding loyalty to the government?

2. Is the government under threat of incursions or subversion by foreign elements?

3. Is the government unable to rally support for a military threat posed by other countries?

4. Is the government's meddling abroad unpopular at home?

Regimes Actions/Capabilities

Repression/Brutality.

1. Does the general public increasingly see the government as more responsible than opposition groups for perpetrating domestic violence?

2. Is the government increasing the use of repression to counter opposition activities? Is there more torture, imprisonment without trial, banning of political parties, or press censorship?

3. Are students becoming restive because of government repression, restrictive policies in education, or school and university closings?

Security Capabilities.

1. Are splits within or between military or police leaders affecting the government's ability to maintain security?

2. Are the military or security services becoming less disciplined; are desertions and acts of disobedience increasing?

3. Are the regular police having difficulty putting down demonstrations or riots? Is the government increasingly using paramilitary police units, hired thugs, or military forces to counteract unrest?

4. Has the situation deteriorated to the extent that government officials are considering declaring or perpetrating martial law?

5. Is the ruler overly cautious about taking tough but necessary measures against rioters or strikers before the situation gets out of hand? Does the regime waffle, sometimes taking tough measures and sometimes not?

6. Have government security capabilities eroded to such an extent that criminals, narcotics traffickers, insurgents, or vigilantes are operating with increasing openness?

Political Disunity/Loss of Confidence.

1. Does the public see the government as inconsistent? Does the average citizen complain that he has "no way of knowing what he can or cannot do to stay out of trouble?"

2. Is conflict breaking out or increasing among groups that make up the ruling elite or between the ruling and supporting elites?

3. Are government leaders doubting their major policies or their ability to rule?

4. Is a weak coalition government leading to legislative paralysis?

5. Is the middle or merchant class starting to withdraw its support for the government?

6. Is the bureaucracy becoming less loyal to the government leadership because of divergent political views or distaste for government policies?

7. Is the ruler considering stepping down because of age, ill health, shift in public opinion, or personal tragedy? Is the political elite gearing up for an obvious succession crisis?

8. Is the ruler's style changing in such a way that lessens his ability to rule? Is he increasingly isolated in the "palace", becoming erratic, or losing his party's loyalty?

9. Is the government introducing reforms that are unpopular with certain groups? Is it unable to enforce these reforms?

<u>Loss of Legitimacy</u>.

1. Has the government shown ineptitude in coping with natural disasters such as earthquakes, hurricanes, floods, and drought?

2. Are media criticism of and jokes about the ruler and government becoming more direct and open?

3. Is effectiveness decreasing because the leadership is firing competent officials as scapegoats?

4. Is effective government control over some areas outside the capital being eroded? Are local officials increasingly unwilling or unable to implement directives or perform services--such as tax collection--for the central government?

5. Has the government lost face with the public because foreign states are ignoring or bypassing it in their dealings with the country? Because the country is being expelled or suspended from international organizations or alliances?

6. Is the regime's ability to govern generally being eroded?

Appendix B: Simple Correlation of Relative Change Values

Country A Simple Correlations in Relative Change Values

	Y	X1	X2	X3	X4	X5	X6
Y	1.0000						
X1	0.1208	1.0000					
X2	0.1997	-0.0876	1.0000				
X3	0.0393	-0.0481	0.1839	1.0000			
X4	-0.1993	-0.3669	-0.0240	-0.2265	1.0000		
X5	0.1209	0.0454	-0.0711	0.0621	0.0172	1.0000	
X6	0.0506	0.2578	-0.2212	-0.2616	0.1472	-0.1176	1.0000
X7	-0.0805	-0.2299	0.0946	-0.2720	-0.0081	0.1596	-0.1623
X8	-0.0067	-0.0359	-0.1166	-0.0909	0.5905	-0.1011	0.0957
X9	0.0621	0.1483	-0.0344	0.3887	-0.0564	-0.0405	-0.0153
X1	-0.0393	0.3063	-0.1607	-0.1482	0.0533	0.1358	0.6896
X1	-0.1077	0.3467	-0.0278	-0.0341	-0.4635	0.0570	-0.1661
X1	0.2702	0.1146	-0.0720	-0.3535	0.0957	-0.2576	0.5052
X1	0.1548	0.3000	-0.0900	0.3450	-0.4273	-0.0352	0.1333
X14	-0.1419	0.4634	-0.0131	0.1906	-0.0590	0.1981	0.0178
X15	-0.2017	-0.0600	0.0082	-0.3136	0.5412	-0.1831	0.6292
X16	-0.2054	-0.3453	0.0911	-0.2578	0.8589	-0.1195	0.2938
X17	-0.0305	0.4147	-0.1586	-0.1940	-0.4300	-0.1514	0.3951
X18	-0.0278	0.1021	-0.2045	-0.2614	0.1983	-0.0597	0.8343
X19	0.0988	0.1412	-0.0345	0.4149	-0.0721	0.0453	-0.0316
X20	-0.0197	0.5901	-0.1747	-0.0098	-0.3820	-0.1575	-0.0954
X21	-0.3675	0.2315	0.1253	0.0732	-0.0031	0.1380	0.1046
X22	0.0398	0.3053	-0.0398	-0.0513	-0.4655	-0.1233	0.0716
X23	0.0615	0.0615	0.1422	-0.0762	0.0319	0.1502	-0.4188
X24	0.2571	0.2433	-0.0740	0.3047	-0.1965	-0.1568	0.0702

	X7	X8	X9	X10	X11	X12	X13
X7	1.0000						
X8	-0.6091	1.0000					
X9	-0.8466	0.5480	1.0000				
X10	-0.3255	0.2260	0.2959	1.0000			
X11	0.1149	-0.1478	0.1321	0.0683	1.0000		
X12	0.1713	-0.0371	-0.1610	0.2325	-0.0370	1.0000	
X13	-0.4760	0.1236	0.5101	0.4482	0.2115	-0.1192	1.0000
X14	-0.1027	-0.0900	0.0154	0.1076	0.0678	-0.0081	0.2067
X15	0.1235	0.1764	-0.2919	0.1977	-0.2164	0.2761	-0.2812
X16	0.0379	0.4559	-0.1803	0.0955	-0.5164	0.1139	-0.4871
X17	0.1801	-0.2852	-0.2083	0.0450	0.5530	0.2748	0.0656
X18	0.0332	0.0036	-0.2597	0.2646	-0.2380	0.2984	-0.1167
X19	-0.8213	0.5150	0.9925	0.2821	0.1362	-0.1871	0.4861
X20	-0.3028	0.0563	0.1919	0.0694	0.2917	-0.0843	0.3633
X21	0.1170	-0.0001	-0.0451	0.2244	0.1632	0.0332	-0.0530
X22	0.1356	-0.2050	-0.0154	0.2282	0.7058	-0.0009	0.4129
X23	-0.0303	0.1276	0.1430	-0.1497	0.1006	0.1814	-0.1508
X24	-0.9054	0.5065	0.8612	0.2922	-0.0380	-0.0966	0.5765

	X14	X15	X16	X17	X18	X19	X20
X14	1.0000						
X15	-0.1451	1.0000					
X16	-0.1578	0.7348	1.0000				
X17	-0.0311	0.2731	-0.3538	1.0000			
X18	-0.0232	0.7573	0.3616	0.5132	1.0000		
X19	0.0074	-0.3083	-0.2001	-0.2093	-0.2605	1.0000	
X20	0.2338	-0.1973	-0.3939	0.3148	-0.1385	0.1758	1.0000
X21	0.0695	-0.0018	-0.0647	0.2105	0.0172	-0.0320	0.0423
X22	-0.0900	-0.0589	-0.4335	0.5029	-0.0812	-0.0261	0.1575
X23	0.1774	-0.4097	-0.0646	-0.3378	-0.5583	0.1544	0.0851
X24	0.0757	-0.3647	-0.2439	-0.1691	-0.1741	0.8427	0.3077

	X21	X22	X23	X24
X21	1.0000			
X22	0.2336	1.0000		
X23	-0.0259	-0.0442	1.0000	
X24	-0.1705	-0.0541	0.1287	1.0000

Country B Simple Correlations in Relative Change Values

	X1	X2	X3	X4	X5	X6	X7
X1	1.0000						
X2	-0.0433	1.0000					
X3	-0.1393	0.3334	1.0000				
X4	-0.4692	-0.1783	0.1419	1.0000			
X5	0.1666	0.2560	0.8502	-0.1199	1.0000		
X6	0.3031	-0.0886	-0.4461	-0.1971	-0.3561	1.0000	
X7	0.3759	0.0081	0.0520	0.0135	0.2652	0.4608	1.0000
X8	0.2798	0.0318	0.1133	-0.0240	0.2496	0.2361	0.8201
X9	0.1697	0.0055	-0.0721	-0.0382	-0.0315	0.3883	0.3404
X10	0.2708	-0.1202	-0.1672	-0.0309	-0.0263	-0.0662	0.0695
X11	0.6462	-0.0446	-0.0377	0.2678	0.0927	0.2412	0.4434
X12	0.1971	0.1091	0.1826	-0.0141	0.1792	-0.2263	-0.1296
X13	0.2448	-0.0248	0.1545	-0.2104	0.3477	0.0072	0.2546
X14	0.7366	-0.0420	-0.3036	-0.2330	-0.0511	0.6420	0.5699
X15	0.6908	0.1110	-0.3434	-0.3440	-0.0651	0.5778	0.4752
X16	0.1838	0.0316	-0.0594	-0.0514	-0.0295	0.3873	0.3595
X17	0.2582	-0.0292	0.0273	0.0256	0.2091	0.3910	0.7099
X18	0.2042	0.1215	0.2401	-0.0191	0.2794	-0.2965	-0.0949
X19	0.6462	-0.0446	-0.0377	0.2678	0.0927	0.2412	0.4434
X20	0.9354	-0.0705	-0.1282	-0.3024	0.1643	0.2669	0.4209
X21	0.8797	-0.0350	-0.2064	-0.3377	0.0910	0.5068	0.5452
X22	0.4082	0.1477	0.2868	-0.1231	0.4395	-0.0840	0.2841
X23	0.9098	-0.0650	-0.1030	-0.1734	0.1620	0.2695	0.4442
X24	0.1517	-0.0739	-0.0696	-0.0134	-0.0289	-0.1354	-0.0768
X25	0.4698	0.2332	0.3305	-0.2875	0.4743	-0.1601	0.2341
X26	-0.2563	-0.2646	-0.0230	-0.0543	-0.0202	-0.2388	-0.1706
X27	0.1074	-0.5260	0.0613	0.1415	0.1031	0.0340	0.1882
Y	0.1414	0.1760	-0.1848	-0.2818	-0.1460	0.1958	-0.1141

	X8	X9	X10	X1	X12	X13	X14
X8	1.0000						
X9	0.0277	1.0000					
X10	-0.0632	-0.2144	1.0000				
X11	0.3232	0.1438	0.1678	1.0000			
X12	-0.3570	0.0633	0.0560	0.1241	1.0000		
X13	-0.0308	0.5439	0.0286	0.0154	0.1749	1.0000	
X14	0.1850	0.4716	0.2333	0.5761	0.2329	0.4175	1.0000
X15	0.1764	0.1125	0.3294	0.4817	0.1735	0.2179	0.8800
X16	0.0443	0.9772	-0.1995	0.1483	0.0530	0.5471	0.4848
X17	0.2690	0.5296	0.1914	0.2672	0.0966	0.5719	0.6662
X18	-0.1975	-0.2153	0.1257	0.1769	0.8616	0.1433	0.1737
X19	0.3232	0.1438	0.1678	1.0000	0.1241	0.0154	0.5761
X20	0.3507	0.1528	0.2444	0.7434	0.2066	0.1237	0.6977
X21	0.2571	0.3819	0.2424	0.6422	0.2459	0.3918	0.9481
X22	0.0205	0.1146	0.1011	0.2907	0.7876	0.4487	0.4937
X23	0.3554	0.1649	0.2376	0.8447	0.2043	0.1086	0.13
X24	-0.0523	-0.0530	0.1539	0.1843	-0.1146	-0.2150	-0.0276
X25	0.1483	0.0147	0.2247	0.1450	0.2331	0.5018	0.2995
X26	0.0057	-0.1166	-0.0206	-0.2882	-0.1241	-0.2020	-0.3740
X27	0.1819	0.0244	0.0849	-0.0004	-0.0797	-0.0013	0.0933
Y	-0.2165	0.1283	0.0284	-0.2029	-0.1665	0.3177	0.1759

	X15	X16	X17	X18	X19	X20	X21
X15	1.0000						
X16	0.1141	1.0000					
X17	0.5095	0.5271	1.0000				
X18	0.2135	-0.2195	0.0201	1.0000			
X19	0.4817	0.1483	0.2672	0.1769	1.0000		
X20	0.6344	0.1643	0.2101	0.2349	0.7434	1.0000	
X21	0.8528	0.3965	0.5548	0.2244	0.6422	0.8416	1.0000
X22	0.4317	0.1340	0.4350	0.8527	0.2907	0.3992	0.5292
X23	0.6225	0.1755	0.2369	0.2360	0.8447	0.9852	0.8337
X24	0.0181	-0.1008	-0.0400	-0.2311	0.1843	0.1581	0.0740
X25	0.3224	0.0514	0.2084	0.3080	0.1450	0.3218	0.3748
X26	-0.3926	-0.1467	-0.1946	-0.0582	-0.2882	-0.2088	-0.3410
X27	-0.0909	0.0316	0.1544	-0.1114	-0.0004	0.1073	0.1174
Y	0.2219	0.1481	0.1218	-0.2270	-0.2029	-0.0816	0.0980

	X22	X23	X24	X25	X26	X27	Y
X22	1.0000						
X23	0.3973	1.0000					
X24	-0.2127	0.1757	1.0000				
X25	0.5133	0.2937	0.0186	1.0000			
X26	-0.1634	-0.2403	0.0384	-0.3333	1.0000		
X27	-0.0033	0.0841	-0.0595	-0.0536	0.1394	1.0000	
Y	-0.1205	-0.1136	-0.1649	0.3488	-0.4536	-0.1985	1.0000

Appendix C: Cross-Correlation Plots of Stability Versus Relative Change Values

This appendix gives the cross-correlation plots for each of the sixteen economic time series' relative change values versus the stability index for each country. The purpose of these plots is to determine lead/lag and positive/negative correlation relationships. Only 9 lags in each direction were used because there are fewer than 40 observations for each series.

The economic time series are identified by the variable coding (X1, X2...) and the country is annotated in parenthesis in the title of each plot.

CROSS CORRELATION PLOT FOR Y AND X1 (A)

```
             -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG    CORR.   +----+----+----+----+----+----+----+----+
 -9   -0.018                       *
 -8   -0.090                       ***
 -7    0.035                       **
 -6    0.068                       ***
 -5    0.077                       ***
 -4    0.138                       ****
 -3    0.138                       ****
 -2    0.137                       ****
 -1    0.250                       *******
  0    0.043                       **
  1   -0.140                    ****
  2   -0.020                      **
  3   -0.075                     ***
  4   -0.064                     ***
  5    0.018                       *
  6   -0.003                       *
  7    0.102                       ****
  8    0.223                       *******
  9    0.225                       *******
```

CROSS CORRELATION PLOT FOR Y AND X2 (A)

```
             -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG    CORR.   +----+----+----+----+----+----+----+----+
 -9    0.100                       ****
 -8    0.094                       ***
 -7    0.213                       ******
 -6    0.210                       ******
 -5    0.188                       ******
 -4   -0.191                  ******
 -3   -0.192                  ******
 -2    0.022                       **
 -1   -0.168                   *****
  0   -0.222                 *******
  1   -0.206                  ******
  2    0.040                       **
  3   -0.199                  ******
  4   -0.221                 *******
  5   -0.211                  ******
  6   -0.166                   *****
  7   -0.025                      **
  8   -0.017                       *
  9   -0.014                       *
```

CROSS CORRELATION PLOT FOR Y AND X3 (A)

```
                     -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG    CORR.          +----+----+----+----+----+----+----+----+
 -9    0.148                              *****
 -8    0.021                              **
 -7    0.040                              **
 -6   -0.045                             **
 -5    0.049                              **
 -4    0.091                              ***
 -3    0.281                              ********
 -2    0.069                              ***
 -1    0.115                              ****
  0    0.019                              *
  1   -0.094                            ***
  2    0.178                              *****
  3   -0.260                        *******
  4   -0.105                           ****
  5   -0.083                            ***
  6    0.055                              **
  7    0.063                              ***
  8   -0.055                             **
  9    0.022                              **
```

CROSS CORRELATION PLOT FOR Y AND X5 (A)

```
                     -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG    CORR.          +----+----+----+----+----+----+----+----+
 -9   -0.085                            ***
 -8   -0.036                             **
 -7   -0.044                              **
 -6   -0.029                             **
 -5   -0.115                           ****
 -4    0.140                              *****
 -3    0.122                              ****
 -2    0.020                              **
 -1    0.044                              **
  0    0.021                              **
  1    0.151                              *****
  2    0.055                              **
  3   -0.202                         ******
  4    0.012                              *
  5    0.225                              *******
  6   -0.192                         ******
  7   -0.231                        *******
  8   -0.122                           ****
  9   -0.035                             **
```

CROSS CORRELATION PLOT FOR Y AND X8 (A)

```
            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9  -0.014                       *
 -8   0.134                       ****
 -7  -0.140                    ****
 -6  -0.253                 *******
 -5  -0.225                 *******
 -4   0.012                       *
 -3  -0.222                 *******
 -2  -0.208                  ******
 -1  -0.092                     ***
  0  -0.076                     ***
  1  -0.041                      **
  2  -0.045                      **
  3  -0.103                    ****
  4  -0.107                    ****
  5  -0.069                     ***
  6  -0.156                   *****
  7   0.148                       *****
  8   0.236                       *******
  9   0.156                       *****
```

CROSS CORRELATION PLOT FOR Y AND X10 (A)

```
            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG CORR.     +----+----+----+----+----+----+----+----+
 -9  -0.025                      **
 -8   0.020                       *
 -7  -0.069                     ***
 -6  -0.006                       *
 -5   0.126                       ****
 -4   0.123                       ****
 -3   0.029                       **
 -2  -0.019                       *
 -1   0.018                       *
  0  -0.003                       *
  1  -0.106                    ****
  2  -0.061                     ***
  3  -0.002                       *
  4  -0.052                      **
  5   0.025                       **
  6  -0.038                      **
  7   0.101                       ****
  8   0.155                       *****
  9  -0.052                      **
```

CROSS CORRELATION PLOT FOR Y AND X11 (A)

```
            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
 LAG  CORR.   +----+----+----+----+----+----+----+----+
  -9  -0.170                  *****
  -8  -0.234                *******
  -7  -0.014                      *
  -6  -0.246                *******
  -5  -0.228                *******
  -4  -0.229                *******
  -3   0.019                      *
  -2  -0.158                  *****
  -1  -0.157                  *****
   0  -0.137                   ****
   1  -0.157                  *****
   2   0.010                      *
   3  -0.021                     **
   4   0.023                      **
   5   0.038                      **
   6   0.028                      **
   7   0.016                      *
   8   0.047                      **
   9   0.065                      ***
```

CROSS CORRELATION PLOT FOR Y AND X12 (A)

```
            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
 LAG  CORR.   +----+----+----+----+----+----+----+----+
  -9  -0.149                  *****
  -8  -0.128                   ****
  -7  -0.181                 ******
  -6   0.038                      **
  -5   0.051                      **
  -4   0.022                      **
  -3   0.158                      *****
  -2   0.171                      *****
  -1   0.227                      *******
   0   0.185                      ******
   1  -0.206                 ******
   2  -0.205                 ******
   3   0.067                      ***
   4  -0.125                   ****
   5  -0.191                 ******
   6  -0.129                   ****
   7  -0.049                     **
   8  -0.092                    ***
   9  -0.091                    ***
```

CROSS CORRELATION PLOT FOR Y AND X13 (A)

```
             -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
 LAG   CORR.   +----+----+----+----+----+----+----+----+
  -9   0.222                       *******
  -8   0.235                       *******
  -7   0.241                       *******
  -6  -0.043                      **
  -5   0.041                       **
  -4  -0.042                      **
  -3  -0.002                       *
  -2  -0.094                     ***
  -1  -0.068                     ***
   0   0.066                       ***
   1  -0.160                   *****
   2  -0.047                      **
   3  -0.055                      **
   4   0.037                       **
   5  -0.039                      **
   6  -0.081                     ***
   7   0.095                       ***
   8   0.307                       *********
   9   0.232                       *******
```

CROSS CORRELATION PLOT FOR Y AND X14 (A)

```
             -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
 LAG   CORR.   +----+----+----+----+----+----+----+----+
  -9   0.033                       **
  -8   0.025                       **
  -7   0.002                       *
  -6   0.016                       *
  -5   0.013                       *
  -4  -0.086                     ***
  -3  -0.062                     ***
  -2  -0.044                      **
  -1  -0.042                      **
   0  -0.166                   *****
   1  -0.153                   *****
   2  -0.183                  ******
   3  -0.211                  ******
   4   0.216                       ******
   5   0.204                       ******
   6   0.233                       *******
   7   0.222                       *******
   8   0.215                       ******
   9   0.300                       *********
```

CROSS CORRELATION PLOT FOR Y AND X15 (A)

```
             -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
  -9  -0.001                       *
  -8   0.076                       ***
  -7  -0.118                    ****
  -6   0.003                       *
  -5   0.173                       *****
  -4   0.052                       **
  -3  -0.142                   *****
  -2  -0.223                 *******
  -1  -0.082                     ***
   0  -0.193                  ******
   1  -0.309               *********
   2  -0.213                  ******
   3  -0.028                      **
   4  -0.058                      **
   5  -0.017                       *
   6   0.091                       ***
   7   0.077                       ***
   8   0.175                       *****
   9  -0.040                      **
```

CROSS CORRELATION PLOT FOR Y AND X17 (A)

```
             -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
 LAG   CORR.   +----+----+----+----+----+----+----+----+
  -9  -0.122                    ****
  -8  -0.113                    ****
  -7  -0.012                       *
  -6  -0.079                     ***
  -5  -0.007                       *
  -4  -0.080                     ***
  -3   0.027                       **
  -2  -0.008                       *
  -1   0.070                       ***
   0  -0.049                      **
   1  -0.193                  ******
   2  -0.009                       *
   3   0.127                       ****
   4   0.067                       ***
   5  -0.031                      **
   6   0.038                       **
   7   0.189                       ******
   8   0.133                       ****
   9   0.059                       **
```

CROSS CORRELATION PLOT FOR Y AND X19 (A)

```
              -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG    CORR.    +----+----+----+----+----+----+----+----+
  -9   0.223                        *******
  -8   0.073                        ***
  -7  -0.118                     ****
  -6  -0.142                    *****
  -5  -0.161                    *****
  -4  -0.033                       **
  -3  -0.008                        *
  -2  -0.068                      ***
  -1  -0.102                     ****
   0  -0.006                        *
   1  -0.085                      ***
   2  -0.002                        *
   3  -0.267                 ********
   4  -0.253                  *******
   5  -0.185                   ******
   6  -0.249                  *******
   7   0.132                        ****
   8   0.153                        *****
   9   0.263                        ********
```

CROSS CORRELATION PLOT FOR Y AND X20 (A)

```
              -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG    CORR.    +----+----+----+----+----+----+----+----+
  -9   0.120                        ****
  -8   0.104                        ****
  -7   0.163                        *****
  -6   0.069                        ***
  -5  -0.063                      ***
  -4  -0.046                       **
  -3   0.201                        ******
  -2   0.192                        ******
  -1   0.043                        **
   0  -0.022                       **
   1  -0.152                    *****
   2  -0.199                   ******
   3  -0.141                    *****
   4  -0.167                    *****
   5  -0.081                      ***
   6   0.091                        ***
   7   0.178                        *****
   8   0.283                        ********
   9   0.439                        ************
```

CROSS CORRELATION PLOT FOR Y AND X21 (A)

```
             -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.    +----+----+----+----+----+----+----+----+
  -9  -0.096                     ***
  -8  -0.113                    ****
  -7  -0.059                      **
  -6  -0.040                      **
  -5  -0.011                       *
  -4   0.102                       ****
  -3   0.034                       **
  -2   0.123                       ****
  -1   0.134                       ****
   0  -0.347              **********
   1  -0.273                ********
   2  -0.169                   *****
   3  -0.180                  ******
   4  -0.058                      **
   5  -0.024                      **
   6   0.066                       ***
   7   0.364                       **********
   8   0.281                       ********
   9   0.047                       **
```

CROSS CORRELATION PLOT FOR Y AND X23 (A)

```
             -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
 LAG   CORR.   +----+----+----+----+----+----+----+----+
  -9  -0.104                    ****
  -8  -0.048                      **
  -7   0.112                       ****
  -6   0.172                       *****
  -5   0.066                       ***
  -4   0.183                       ******
  -3   0.149                       *****
  -2   0.222                       *******
  -1   0.084                       ***
   0   0.061                       ***
   1   0.055                       **
   2  -0.284                ********
   3  -0.321               *********
   4  -0.341              **********
   5  -0.217                  ******
   6  -0.364              **********
   7  -0.321               *********
   8  -0.318               *********
   9   0.101                       ****
```

CROSS CORRELATION PLOT FOR Y AND X1 (B)

```
            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9   0.083                       ***
 -8   0.108                       ****
 -7   0.104                       ****
 -6   0.113                       ****
 -5   0.111                       ****
 -4   0.216                       ******
 -3   0.279                       ********
 -2   0.295                       ********
 -1   0.332                       *********
  0   0.141                       *****
  1   0.174                       *****
  2   0.067                       ***
  3   0.016                       *
  4  -0.014                       *
  5  -0.031                      **
  6   0.017                       *
  7  -0.044                      **
  8  -0.127                    ****
  9  -0.040                      **
```

CROSS CORRELATION PLOT FOR Y AND X2 (B)

```
            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9   0.296                       ********
 -8   0.287                       ********
 -7   0.304                       *********
 -6   0.278                       ********
 -5   0.247                       *******
 -4   0.214                       ******
 -3   0.207                       ******
 -2   0.174                       *****
 -1   0.169                       *****
  0   0.176                       *****
  1   0.139                       ****
  2   0.036                       **
  3   0.046                       **
  4  -0.011                       *
  5  -0.134                    ****
  6  -0.217                  ******
  7  -0.274                ********
  8  -0.312               *********
  9  -0.358              **********
```

CROSS CORRELATION PLOT FOR Y AND X3 (B)

```
                  -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.         +----+----+----+----+----+----+----+----+
 -9   0.160                             *****
 -8   0.114                             ****
 -7   0.140                             *****
 -6   0.223                             *******
 -5   0.192                             ******
 -4   0.076                             ***
 -3   0.029                             **
 -2  -0.069                           ***
 -1  -0.161                         *****
  0  -0.185                        ******
  1  -0.159                         *****
  2  -0.011                             *
  3   0.110                             ****
  4   0.073                             ***
  5   0.108                             ****
  6   0.075                             ***
  7  -0.005                             *
  8  -0.025                             **
  9  -0.193                        ******
```

CROSS CORRELATION PLOT FOR Y AND X4 (B)

```
                  -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.         +----+----+----+----+----+----+----+----+
 -9  -0.051                            **
 -8  -0.049                            **
 -7  -0.213                        ******
 -6  -0.249                       *******
 -5  -0.366                    **********
 -4  -0.373                    **********
 -3  -0.229                       *******
 -2  -0.259                       *******
 -1  -0.362                    **********
  0  -0.282                      ********
  1  -0.389                   ***********
  2  -0.259                       *******
  3  -0.300                     *********
  4  -0.168                         *****
  5  -0.184                        ******
  6  -0.240                       *******
  7  -0.135                          ****
  8   0.117                             ****
  9   0.091                             ***
```

CROSS CORRELATION PLOT FOR Y AND X6 (B)

```
             -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG    CORR.   +----+----+----+----+----+----+----+----+
 -9     0.005                      *
 -8    -0.022                     **
 -7    -0.036                     **
 -6    -0.127                   ****
 -5    -0.202                 ******
 -4    -0.037                     **
 -3    -0.047                     **
 -2     0.168                      *****
 -1     0.241                      *******
  0     0.196                      ******
  1     0.250                      *******
  2     0.068                      ***
  3    -0.061                    ***
  4    -0.203                 ******
  5    -0.218                 ******
  6    -0.069                    ***
  7    -0.134                   ****
  8    -0.028                     **
  9     0.177                      *****
```

CROSS CORRELATION PLOT FOR Y AND X8 (B)

```
             -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG    CORR.   +----+----+----+----+----+----+----+----+
 -9     0.046                      **
 -8     0.073                      ***
 -7     0.082                      ***
 -6     0.057                      **
 -5    -0.020                     **
 -4    -0.057                     **
 -3    -0.097                    ***
 -2    -0.036                     **
 -1    -0.171                  *****
  0    -0.216                 ******
  1    -0.202                 ******
  2    -0.404            ***********
  3    -0.248                *******
  4    -0.302              *********
  5    -0.321              *********
  6    -0.168                  *****
  7    -0.226                *******
  8    -0.179                  *****
  9    -0.197                 ******
```

```
                 CROSS CORRELATION PLOT FOR Y AND X10 (B)

            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9  -0.038                      **
 -8  -0.025                      **
 -7  -0.056                      **
 -6  -0.021                      **
 -5  -0.004                       *
 -4  -0.044                      **
 -3  -0.001                       *
 -2   0.002                       *
 -1   0.019                       *
  0   0.028                       **
  1  -0.044                      **
  2  -0.028                      **
  3  -0.276                ********
  4  -0.239                 *******
  5  -0.185                  ******
  6  -0.178                   *****
  7  -0.182                  ******
  8  -0.198                  ******
  9  -0.233                 *******
```

```
                 CROSS CORRELATION PLOT FOR Y AND X13 (B)

            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9  -0.034                      **
 -8   0.038                       **
 -7   0.130                       ****
 -6   0.348                       **********
 -5   0.390                       ***********
 -4   0.440                       ************
 -3   0.459                       ************
 -2   0.425                       ************
 -1   0.329                       *********
  0   0.318                       *********
  1   0.344                       **********
  2   0.367                       **********
  3   0.379                       **********
  4   0.494                       *************
  5   0.528                       **************
  6   0.647                       *****************
  7   0.570                       ***************
  8   0.540                       **************
  9   0.436                       ************
```

CROSS CORRELATION PLOT FOR Y AND X16 (B)

```
            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9   -0.104                 ****
 -8    0.056                    **
 -7    0.098                    ***
 -6    0.228                    *******
 -5    0.287                    ********
 -4    0.430                    ************
 -3    0.341                    **********
 -2    0.340                    *********
 -1    0.170                    *****
  0    0.148                    *****
  1    0.182                    ******
  2    0.245                    *******
  3    0.283                    ********
  4    0.299                    ********
  5    0.337                    *********
  6    0.416                    ***********
  7    0.323                    *********
  8    0.391                    ***********
  9    0.315                    *********
```

CROSS CORRELATION PLOT FOR Y AND X17 (B)

```
            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9   -0.078                  ***
 -8    0.054                    **
 -7    0.075                    ***
 -6    0.235                    *******
 -5    0.136                    ****
 -4    0.179                    *****
 -3    0.204                    ******
 -2    0.322                    *********
 -1    0.129                    ****
  0    0.122                    ****
  1    0.055                    **
  2    0.072                    ***
  3   -0.029                   **
  4    0.071                    ***
  5    0.136                    ****
  6    0.281                    ********
  7    0.085                    ***
  8    0.189                    ******
  9    0.117                    ****
```

```
                    CROSS CORRELATION PLOT FOR Y AND X19 (B)

            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9   0.048                        **
 -8   0.060                        ***
 -7  -0.036                       **
 -6  -0.059                       **
 -5  -0.186                   ******
 -4  -0.075                      ***
 -3   0.059                        **
 -2   0.044                        **
 -1  -0.002                        *
  0  -0.203                   ******
  1  -0.172                    *****
  2  -0.210                   ******
  3  -0.312                *********
  4  -0.198                   ******
  5  -0.244                  *******
  6  -0.212                   ******
  7  -0.234                  *******
  8  -0.120                     ****
  9  -0.011                        *
```

```
                    CROSS CORRELATION PLOT FOR Y AND X22 (B)

            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9   0.058                        **
 -8   0.153                        *****
 -7   0.202                        ******
 -6   0.277                        ********
 -5   0.232                        *******
 -4   0.241                        *******
 -3   0.196                        ******
 -2   0.197                        ******
 -1   0.105                        ****
  0  -0.121                     ****
  1  -0.238                  *******
  2  -0.167                    *****
  3  -0.139                     ****
  4   0.084                        ***
  5   0.193                        ******
  6   0.221                        *******
  7   0.141                        *****
  8   0.101                        ****
  9   0.041                        **
```

```
                 CROSS CORRELATION PLOT FOR Y AND X24 (B)

            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9  -0.081                     ***
 -8  -0.081                     ***
 -7  -0.095                     ***
 -6  -0.110                    ****
 -5  -0.151                   *****
 -4  -0.071                     ***
 -3  -0.011                       *
 -2  -0.176                   *****
 -1  -0.189                  ******
  0  -0.165                   *****
  1  -0.227                 *******
  2  -0.051                      **
  3  -0.000                       *
  4  -0.072                     ***
  5  -0.110                    ****
  6  -0.083                     ***
  7  -0.036                      **
  8  -0.152                   *****
  9  -0.208                  ******
```

```
                 CROSS CORRELATION PLOT FOR Y AND X25 (B)

            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   + ---+----+----+----+----+----+----+----+
 -9   0.147                       *****
 -8   0.184                       ******
 -7   0.202                       ******
 -6   0.262                       ********
 -5   0.340                       *********
 -4   0.367                       **********
 -3   0.463                       *************
 -2   0.459                       ************
 -1   0.450                       ************
  0   0.349                       **********
  1   0.174                       *****
  2   0.119                       ****
  3   0.142                       *****
  4   0.115                       ****
  5   0.147                       *****
  6   0.197                       ******
  7   0.243                       *******
  8   0.133                       ****
  9   0.037                       **
```

CROSS CORRELATION PLOT FOR Y AND X26 (B)

```
            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9  -0.250                 *******
 -8  -0.244                 *******
 -7  -0.114                    ****
 -6  -0.096                     ***
 -5  -0.030                      **
 -4  -0.140                    ****
 -3  -0.233                 *******
 -2  -0.247                 *******
 -1  -0.476           *************
  0  -0.454            ************
  1  -0.298                ********
  2  -0.294                ********
  3  -0.161                   *****
  4  -0.020                       *
  5   0.038                       **
  6   0.000                       *
  7  -0.035                      **
  8  -0.043                      **
  9  -0.099                     ***
```

CROSS CORRELATION PLOT FOR Y AND X27 (B)

```
            -0.8 -0.6 -0.4 -0.2  0.0  0.2  0.4  0.6  0.8
LAG   CORR.   +----+----+----+----+----+----+----+----+
 -9  -0.037                      **
 -8   0.004                       *
 -7  -0.169                   *****
 -6  -0.161                   *****
 -5  -0.174                   *****
 -4  -0.186                  ******
 -3  -0.211                  ******
 -2  -0.237                 *******
 -1  -0.259                 *******
  0  -0.199                  ******
  1  -0.165                   *****
  2  -0.024                      **
  3   0.013                       *
  4  -0.034                      **
  5   0.001                       *
  6   0.038                       **
  7   0.039                       **
  8   0.006                       *
  9  -0.028                      **
```

Appendix D: Principal Component Analysis

COUNTRY A
EIGENVALUES / EIGENVECTORS BASED ON CORRELATION MATRIX

	EIGENVALUES	PERCENT OF VARIANCE	CUMULATIVE PERCENT OF VARIANCE
1	9.959	71.1	71.1
2	2.519	18.0	89.1
3	5.883E-01	4.2	93.3
4	4.420E-01	3.2	96.5
5	1.632E-01	1.2	97.7
6	1.102E-01	0.8	98.4
7	9.557E-02	0.7	99.1
8	6.521E-02	0.5	99.6
9	2.410E-02	0.2	99.8
10	1.324E-02	0.1	99.9
11	8.670E-03	0.1	99.9
12	5.242E-03	0.0	100.0
13	3.846E-03	0.0	100.0
14	2.011E-03	0.0	100.0

VECTORS

FACTOR	1	2	3	4	5	6	7
X1	-0.2877	-0.2326	0.0400	0.1002	0.1895	0.2447	-0.3417
X2	0.0906	0.5782	-0.2443	0.1648	0.0491	-0.3190	-0.3047
X3	-0.2414	0.2888	0.1368	0.5271	-0.6557	0.0067	0.1984
X5	0.0478	0.4771	0.7403	-0.4205	0.0311	0.0610	-0.1045
X8	-0.3145	-0.0115	-0.0314	-0.0473	0.1004	-0.0897	-0.1710
X10	-0.3018	0.0019	-0.0335	-0.2221	-0.2724	0.3871	-0.3209
X11	-0.2952	0.0189	0.2596	0.1678	0.4416	-0.1431	0.5578
X12	-0.1214	0.5155	-0.4614	-0.1306	0.2512	0.5243	0.2864
X13	-0.3143	-0.0021	-0.0149	-0.1431	-0.0412	-0.1535	0.0325
X14	-0.3053	-0.0956	0.1631	0.1170	-0.0772	0.3377	0.1037
X15	-0.3017	0.0809	-0.1828	-0.2658	-0.1097	-0.3780	-0.0570
X17	-0.3102	-0.0164	-0.0913	-0.1992	-0.0340	-0.2774	0.1673
X19	-0.2876	0.1233	0.1157	0.4334	0.3943	-0.0721	-0.4127
X20	-0.3075	-0.0573	-0.0873	-0.2812	-0.1097	-0.1366	0.0358

VECTORS

FACTOR	8	9	10	11	12	13	14
X1	0.2658	0.0321	-0.5873	0.3375	-0.2757	0.0740	0.1640
X2	-0.1232	0.5213	-0.2004	0.1222	0.1284	0.1223	0.0110
X3	0.0797	-0.1824	-0.1492	-0.0555	-0.1656	-0.0058	0.0024
X5	0.1474	-0.0611	-0.0395	0.0225	-0.0444	0.0091	-0.0018
X8	0.1116	-0.1735	-0.2775	-0.7035	0.3748	0.3014	-0.0686
X10	-0.6999	0.0181	0.0971	0.0370	-0.0445	0.1584	-0.0582
X11	-0.4706	0.0720	-0.2408	0.0689	0.0136	0.0048	-0.0262
X12	0.1657	-0.1730	0.0195	-0.0348	-0.0846	-0.0542	0.0238
X13	0.0264	0.2219	0.2141	-0.2110	-0.1532	-0.1673	0.8139
X14	0.2682	0.4382	0.2275	0.2010	0.6037	-0.0368	-0.0688
X15	-0.0121	-0.4598	-0.0928	0.4310	0.3850	-0.2915	0.0334
X17	0.2226	0.0445	0.2904	0.2228	-0.2661	0.6825	-0.1651
X19	0.0197	-0.2087	0.4962	-0.0241	-0.1448	-0.1844	-0.1553
X20	0.1099	0.3557	-0.0975	-0.2109	-0.3169	-0.4965	-0.4939

PRINCIPAL COMPONENT SCORES

P1 = FIRST PRINCIPAL COMPONENT

CASE	P1	P2	P3	P4	P5	P6	P7
1	3.947	-2.318	0.362	0.193	-0.556	0.394	-0.091
2	3.542	-2.269	0.513	0.079	-0.027	0.304	0.219
3	3.589	-2.217	0.260	0.146	0.310	0.248	0.153
4	3.313	-2.018	0.211	0.012	0.038	0.252	0.112
5	2.924	-1.877	0.310	0.252	-0.040	0.184	0.235
6	3.085	-1.784	0.359	0.015	0.054	0.082	0.241
7	3.076	-1.344	0.115	0.299	0.000	-0.381	0.092
8	2.959	-1.282	-0.302	-0.233	0.337	-0.248	-0.068
9	2.768	-1.120	-0.239	0.232	0.002	-0.350	0.011
10	2.856	-0.256	1.106	-0.827	0.098	-0.085	-0.389
11	2.789	0.002	0.051	0.434	-0.661	-0.716	-0.483
12	2.464	0.625	-1.634	-0.044	0.052	0.094	-0.275
13	2.388	0.649	-1.756	-0.259	0.379	0.078	-0.213
14	2.042	2.181	1.081	-0.844	0.174	0.008	-0.637
15	1.496	1.568	-0.900	0.682	-0.098	0.098	0.030
16	1.333	1.500	-1.457	0.743	-0.101	0.239	0.183
17	1.264	2.266	-0.167	-0.272	0.255	0.344	-0.118
18	1.268	2.647	0.374	-0.638	0.480	0.348	0.015
19	1.364	2.022	-0.100	-0.106	0.265	0.058	0.100
20	0.936	1.864	-0.006	-0.050	-0.341	-0.200	-0.089
21	0.781	1.547	-0.522	-0.204	-0.198	-0.244	-0.028
22	0.131	2.792	1.486	-0.812	-0.377	0.030	0.314
23	-0.123	1.947	0.486	-0.089	-0.367	-0.293	0.595
24	-0.600	1.417	-0.191	-0.219	-0.287	-0.496	0.810
25	-3.126	0.708	0.011	1.817	-0.255	0.165	-0.268
26	-3.443	0.764	0.474	1.198	0.007	0.355	-0.372
27	-3.622	0.393	0.805	1.555	0.219	-0.027	0.190
28	-3.302	-0.339	0.166	0.609	0.918	-0.600	0.184
29	-3.889	-0.828	-0.240	0.090	1.156	-0.156	-0.100

CASE	P1	P2	P3	P4	P5	P6	P7
30	-3.986	-0.459	1.074	-0.408	0.075	0.181	-0.569
31	-4.535	-0.852	0.813	0.276	-0.608	0.020	-0.123
32	-4.465	-1.200	0.122	-0.024	-0.102	-0.250	0.018
33	-5.181	-0.319	-0.710	-0.587	-0.247	1.034	0.305
34	-4.498	-1.474	-0.145	-1.211	0.516	-0.174	0.128
35	-4.695	-1.135	-0.295	-0.866	-0.330	0.023	0.328
36	-4.850	-1.802	-1.513	-0.940	-0.740	-0.323	-0.439

CASE	P8	P9	P10	P11	P12	P13	P14
1	0.376	0.089	0.064	0.002	0.071	-0.075	0.092
2	0.069	0.161	0.001	0.105	-0.061	0.098	0.035
3	0.008	0.325	0.050	0.116	-0.018	0.026	-0.010
4	-0.037	-0.041	0.105	0.146	-0.076	0.034	-0.039
5	-0.029	-0.128	0.020	-0.152	0.098	0.052	-0.054
6	0.008	-0.174	0.070	-0.160	0.037	0.008	-0.064
7	-0.192	0.015	-0.166	-0.078	-0.033	0.023	-0.029
8	-0.360	-0.155	-0.109	-0.010	0.034	0.026	0.007
9	-0.177	-0.265	-0.020	-0.079	-0.020	-0.111	0.024
10	-0.053	-0.291	0.045	-0.049	-0.109	-0.082	0.014
11	-0.028	0.225	-0.252	0.007	0.002	-0.018	0.037
12	0.067	-0.051	-0.058	0.086	-0.054	0.016	0.044
13	0.032	-0.066	-0.040	0.035	0.040	-0.005	0.066
14	0.280	-0.079	-0.026	0.183	-0.015	-0.022	-0.074
15	0.008	0.076	-0.001	0.107	0.034	-0.162	-0.076
16	-0.000	0.124	0.093	0.020	-0.076	-0.025	-0.061
17	0.203	0.054	-0.013	-0.129	0.056	0.074	-0.048
18	0.182	0.052	-0.071	-0.078	0.014	-0.026	0.012
19	0.106	0.227	-0.037	-0.140	0.029	0.018	-0.027
20	0.003	0.044	0.112	-0.017	0.054	0.067	0.012
21	-0.130	0.036	0.272	-0.112	0.124	0.025	0.056
22	-0.089	-0.046	-0.036	0.025	-0.059	0.049	0.074
23	-0.059	0.019	0.021	-0.002	-0.062	0.001	0.033
24	-0.307	-0.167	0.048	0.197	0.033	0.024	-0.040
25	-0.244	-0.186	-0.086	-0.025	-0.005	-0.001	-0.006
26	-0.549	0.104	-0.061	-0.008	-0.055	0.116	0.013
27	0.401	0.001	0.057	-0.093	-0.129	-0.054	0.023
28	0.577	-0.103	0.039	0.037	-0.041	0.021	0.003
29	-0.227	0.018	0.160	0.074	0.068	-0.007	0.081
30	-0.237	0.049	0.118	-0.001	0.001	-0.024	-0.041
31	-0.082	0.052	0.134	0.096	0.170	-0.072	-0.012
32	0.601	-0.075	-0.254	0.066	0.153	0.080	-0.020
33	-0.016	-0.306	-0.171	0.029	0.002	-0.015	0.034
34	-0.485	0.251	-0.143	-0.043	-0.005	-0.055	-0.032
35	0.148	0.270	-0.050	-0.097	-0.068	-0.101	0.010
36	0.231	-0.060	0.183	-0.058	-0.134	0.098	-0.036

COUNTRY B

EIGENVALUES / EIGENVECTORS BASED ON CORRELATION MATRIX

	EIGENVALUES	PERCENT OF VARIANCE	CUMULATIVE PERCENT OF VARIANCE
1	11.70	73.1	73.1
2	2.229	13.9	87.0
3	0.957	6.0	93.0
4	4.827E-01	3.0	96.0
5	2.854E-01	1.8	97.8
6	1.758E-01	1.1	98.9
7	7.649E-02	0.5	99.4
8	5.701E-02	0.4	99.8
9	1.951E-02	0.1	99.9
10	6.835E-03	0.0	99.9
11	4.922E-03	0.0	100.0
12	4.241E-03	0.0	100.0
13	1.208E-03	0.0	100.0
14	1.017E-03	0.0	100.0
15	6.605E-04	0.0	100.0
16	2.400E-04	0.0	100.0

VECTORS

FACTOR	1	2	3	4	5	6	7
X1	0.2889	-0.0337	-0.0512	0.0743	-0.1945	-0.0945	-0.0213
X2	0.2542	0.1715	0.2397	-0.2185	0.5139	0.2630	-0.2350
X3	0.2152	0.3662	-0.0398	0.4786	0.2787	0.2655	0.1438
X4	0.1303	0.0444	-0.8820	-0.2817	0.0740	0.2100	-0.2583
X6	0.2450	-0.3090	0.1688	-0.2931	-0.0374	0.2550	-0.0127
X8	0.2712	0.1321	0.1910	-0.0122	0.3100	0.1084	-0.1311
X10	0.2791	0.0335	-0.1073	0.2493	-0.0084	-0.4657	-0.2485
X13	0.2690	-0.2483	0.0092	0.2762	-0.1756	0.1200	0.0576
X16	0.2647	-0.2516	0.0583	-0.0497	-0.2174	0.2919	0.1305
X17	0.2807	-0.1776	0.0290	0.0656	-0.0829	0.0340	-0.0688
X19	0.2890	-0.0823	0.0294	-0.0132	-0.1142	-0.0295	0.0369
X22	0.2822	0.0252	-0.0481	0.2720	0.0351	-0.3431	-0.2047
X24	0.1376	0.4999	0.2402	-0.4681	-0.3915	-0.1689	-0.3313
X25	0.2812	-0.1681	0.0052	0.1058	-0.1121	-0.0006	0.0005
X26	-0.2637	-0.0259	0.0998	0.4039	-0.3124	0.4455	-0.6614
X27	0.1590	0.5260	-0.0940	0.0995	-0.3932	0.2596	0.4027

FACTOR	VECTORS 8	9	10	11	12	13	14
X1	-0.0296	-0.2199	-0.4080	-0.4268	0.0703	0.1149	0.0973
X2	0.3132	0.3983	-0.1002	0.1173	0.0482	-0.1719	-0.0128
X3	0.3388	-0.4871	0.0409	-0.0911	-0.1058	0.0938	-0.0523
X4	-0.0312	-0.0175	0.0431	-0.0310	-0.0208	0.0213	-0.0021
X6	-0.0734	-0.2973	-0.4489	0.4294	-0.1924	0.2995	-0.1202
X8	-0.7770	-0.0875	0.1884	-0.1738	0.0336	0.0501	0.2379
X10	0.0127	-0.1489	-0.0823	0.5232	0.0968	-0.3572	0.3458
X13	0.0886	0.0407	0.2497	0.0765	-0.2870	0.0422	0.2475
X16	0.2495	0.1174	0.1501	-0.1510	0.4690	0.0348	0.4729
X17	-0.0826	-0.1465	0.1627	0.0383	0.5532	-0.2124	-0.6490
X19	-0.0047	0.1608	-0.2736	-0.3897	-0.3858	-0.5741	-0.1314
X22	0.0529	0.4548	-0.1509	-0.0975	0.0455	0.5768	-0.1466
X24	0.1883	-0.2197	0.2099	-0.0960	-0.0393	0.0893	-0.0125
X25	-0.0001	0.0966	0.5399	0.1032	-0.4095	0.0748	-0.2215
X26	-0.0643	0.0639	-0.0895	0.0112	-0.0470	-0.0553	0.0102
X27	-0.2382	0.3254	-0.1537	0.3082	0.0538	-0.0339	-0.0533

FACTOR	VECTORS 15	16
X1	-0.6577	0.0441
X2	-0.3133	-0.0388
X3	0.1875	0.0164
X4	0.0498	-0.0018
X6	0.1758	0.1089
X8	0.1003	-0.0055
X10	0.0011	0.0961
X13	-0.0883	-0.7620
X16	0.2377	0.2977
X17	-0.0016	-0.2079
X19	0.3763	0.0589
X22	0.2855	-0.0542
X24	0.1174	-0.0482
X25	-0.2870	0.5026
X26	-0.0078	0.0357
X27	-0.0837	-0.0040

PRINCIPAL COMPONENT SCORES

CASE	P1	P2	P3	P4	P5	P6
1	-2.555	-0.791	-2.774	-0.608	0.374	0.025
2	-2.753	-0.815	-2.332	-0.211	0.161	0.172
3	-2.829	-0.792	-1.994	-0.043	0.060	0.198
4	-2.795	-0.719	-1.183	0.036	0.064	-0.150
5	-2.882	-0.688	-1.273	0.194	-0.081	0.113
6	-2.953	-0.763	-1.165	0.212	-0.166	0.123

CASE	P1	P2	P3	P4	P5	P6
7	-2.893	-0.678	-0.543	0.182	-0.151	-0.208
8	-3.028	-0.629	0.612	0.822	-0.221	-0.268
9	-2.980	-0.695	0.532	0.566	-0.271	-0.352
10	-3.105	-0.512	1.153	0.459	-0.771	-0.426
11	-2.943	-0.479	0.102	0.179	-0.782	-0.044
12	-2.744	-0.305	0.238	-0.086	-0.818	-0.190
13	-2.541	-0.002	0.482	-0.068	-0.742	-0.242
14	-2.453	0.029	0.652	0.046	-0.608	-0.155
15	-2.298	0.031	0.818	0.156	-0.334	-0.129
16	-2.037	0.129	1.132	0.236	-0.059	-0.167
17	-1.824	0.186	0.801	0.316	0.259	0.056
18	-1.672	0.397	0.805	0.454	0.359	0.326
19	-1.570	0.401	0.858	0.596	0.601	0.480
20	-1.344	0.460	0.910	0.573	0.726	0.604
21	-1.272	0.469	0.731	0.400	0.669	0.548
22	-1.110	0.505	0.682	-0.030	0.684	0.423
23	-1.019	0.626	0.646	-0.236	0.249	0.477
24	-0.675	0.627	0.602	-0.329	0.255	0.347
25	-0.034	0.643	0.452	-1.095	0.819	-0.322
26	0.156	0.432	0.614	-1.439	0.670	-0.638
27	0.547	0.642	0.543	-1.530	0.268	-0.624
28	1.521	1.515	0.544	-1.337	0.029	-0.401
29	2.220	2.106	-0.648	-1.036	-0.088	0.143
30	3.087	2.866	-0.703	0.109	0.011	0.360
31	3.654	2.556	-0.638	0.497	-0.020	0.374
32	5.446	2.397	-0.837	0.156	-0.790	0.013
33	6.420	2.976	-0.419	0.624	-0.953	-0.452
34	6.473	0.063	-0.348	1.821	0.708	-0.232
35	5.896	-2.277	-0.400	1.100	0.850	-1.117
36	6.135	-3.580	0.285	-0.363	0.411	-0.285
37	6.296	-2.927	0.444	-0.696	-0.459	0.909
38	6.460	-3.402	0.622	-0.625	-0.913	0.710

CASE	P7	P8	P9	P10	P11	P12
1	0.197	0.008	0.055	0.059	-0.005	0.019
2	-0.035	-0.013	0.031	0.006	-0.008	-0.006
3	-0.112	0.002	0.013	-0.009	-0.011	-0.018
4	0.312	0.087	-0.065	0.021	-0.011	0.009
5	-0.056	0.058	-0.057	-0.009	-0.012	-0.022
6	-0.158	-0.015	0.026	-0.031	0.004	-0.007
7	0.195	0.072	-0.063	0.021	-0.013	0.009
8	0.420	0.181	-0.181	-0.046	-0.004	-0.002
9	0.363	0.011	-0.066	-0.036	-0.017	0.021
10	-0.003	-0.024	0.004	0.006	-0.010	0.018
11	-0.429	-0.242	0.082	-0.008	0.002	0.001
12	-0.356	-0.224	0.119	0.023	0.027	0.028
13	-0.178	-0.094	-0.062	0.093	-0.019	-0.014
14	-0.188	-0.044	-0.012	0.053	-0.002	-0.014
15	0.061	-0.054	0.053	-0.015	0.035	-0.007
16	0.381	-0.056	0.032	-0.036	0.064	0.027

CASE	P7	P8	P9	P10	P11	P12
17	0.433	-0.113	0.084	-0.085	0.090	0.005
18	0.132	0.039	-0.048	-0.048	0.026	-0.033
19	-0.070	0.136	-0.130	-0.024	-0.055	-0.065
20	-0.076	0.077	-0.086	-0.022	-0.024	-0.003
21	-0.124	0.090	-0.043	0.017	-0.025	-0.006
22	-0.331	0.179	0.000	0.097	-0.065	0.012
23	-0.649	0.030	0.172	0.036	-0.018	0.013
24	-0.383	-0.034	0.180	-0.050	0.074	0.051
25	0.254	0.105	-0.014	0.107	-0.086	0.024
26	0.186	-0.013	0.051	0.077	-0.093	0.023
27	0.034	-0.057	0.076	-0.061	-0.070	-0.074
28	0.074	-0.063	0.019	-0.078	0.056	-0.005
29	-0.103	-0.290	-0.006	-0.064	0.186	0.016
30	0.341	0.124	-0.069	-0.022	0.161	0.007
31	0.077	0.248	-0.072	0.045	-0.007	-0.017
32	-0.132	0.012	-0.094	-0.290	-0.224	0.090
33	-0.110	0.245	-0.107	0.245	0.007	-0.088
34	0.248	-0.760	0.284	0.102	-0.053	0.121
35	-0.407	0.389	0.188	-0.130	0.066	-0.158
36	-0.428	-0.086	-0.521	0.022	0.082	0.159
37	0.285	-0.618	-0.097	0.003	-0.051	-0.215
38	0.334	0.704	0.326	0.031	0.003	0.103

CASE	P13	P14	P15	P16
1	0.010	-0.015	-0.014	-0.017
2	-0.010	-0.009	-0.003	0.006
3	-0.017	-0.005	-0.001	0.013
4	0.005	-0.016	0.000	-0.006
5	-0.006	-0.011	0.017	0.012
6	-0.024	-0.000	-0.009	0.015
7	0.009	-0.001	0.002	-0.005
8	-0.002	-0.016	0.009	0.012
9	-0.006	0.018	-0.009	0.010
10	-0.015	0.028	-0.019	-0.004
11	0.004	0.028	0.020	0.008
12	-0.012	0.015	-0.006	-0.017
13	0.042	0.007	0.062	-0.021
14	0.011	0.010	0.022	-0.013
15	-0.006	0.008	-0.024	-0.002
16	0.003	-0.020	-0.029	-0.014
17	-0.006	-0.009	-0.054	-0.001
18	0.025	-0.022	0.005	0.010
19	0.024	0.007	0.029	0.019
20	0.015	-0.026	0.017	-0.002
21	0.015	0.000	0.011	0.010
22	0.022	0.009	-0.010	-0.008
23	-0.039	0.006	-0.044	-0.003
24	-0.034	-0.066	-0.016	-0.005
25	0.029	-0.018	0.006	-0.028
26	0.019	0.034	-0.026	-0.004

CASE	P13	P14	P15	P16
27	-0.032	0.049	-0.005	0.050
28	-0.088	-0.076	0.076	-0.002
29	0.131	0.026	0.008	0.016
30	-0.035	0.044	0.001	-0.017
31	-0.072	0.099	0.017	-0.014
32	0.030	-0.020	-0.019	-0.014
33	0.010	-0.073	-0.040	0.023
34	-0.006	0.000	0.029	0.014
35	0.024	0.009	0.006	-0.021
36	-0.026	0.007	-0.015	0.005
37	-0.011	-0.007	-0.016	-0.017
38	0.022	0.004	0.021	0.014

Appendix E: Factor Analysis Output

Country A Original Values Excluding Stability Index.

	1	2	3	4	5
EIGENVALUE	9.958930	2.519476	0.588342	0.441951	0.163199
DIFFERENCE	7.439454	1.931134	0.146390	0.278752	0.052980
PROPORTION	0.7114	0.1800	0.0420	0.0316	0.0117
CUMULATIVE	0.7114	0.8913	0.9333	0.9649	0.9766

	6	7	8	9	10
EIGENVALUE	0.110219	0.095573	0.065206	0.024097	0.013237
DIFFERENCE	0.014646	0.030367	0.041109	0.010860	0.004567
PROPORTION	0.0079	0.0068	0.0047	0.0017	0.0009
CUMULATIVE	0.9844	0.9913	0.9959	0.9976	0.9986

	11	12	13	14
EIGENVALUE	0.008670	0.005242	0.003846	0.002011
DIFFERENCE	0.003427	0.001397	0.001835	
PROPORTION	0.0006	0.0004	0.0003	0.0001
CUMULATIVE	0.9992	0.9996	0.9999	1.0000

Factor Loadings Matrix

	FACTOR1	FACTOR2
A1	0.90779	-0.36914
A2	-0.28605	0.91774
A3	0.76192	0.45834
A5	-0.15083	0.75730
A8	0.99239	-0.01831
A10	0.95229	0.00298
A11	0.93156	0.02992
A12	0.38318	0.81817
A13	0.99199	-0.00330
A14	0.96355	-0.15175
A15	0.95220	0.12839
A20	0.97902	-0.02602
A17	0.90773	0.19565
A19	0.97048	-0.09099

Factor Variance

FACTOR1	FACTOR2
9.958930	2.519476

Communality Estimates: TOTAL = 12.478406

A1	A2	A3	A5	A8	A10	A11
0.96	0.92	0.79	0.60	0.99	0.91	0.87

A12	A13	A14	A15	A20	A17	A19
0.82	0.98	0.95	0.92	0.96	0.86	0.95

Country A Original Values Factor Scores

OBS	FACTOR1	FACTOR2
1	-1.2506	-1.4604
2	-1.1224	-1.4295
3	-1.1374	-1.3966
4	-1.0499	-1.2711
5	-0.9267	-1.1826
6	-0.9776	-1.1239
7	-0.9747	-0.8465
8	-0.9377	-0.8079
9	-0.8770	-0.7054
10	-0.9050	-0.1616
11	-0.8838	0.0015
12	-0.7807	0.3940
13	-0.7567	0.4089
14	-0.6469	1.3738
15	-0.4742	0.9881
16	-0.4224	0.9453
17	-0.4005	1.4277
18	-0.4017	1.6677
19	-0.4323	1.2737
20	-0.2966	1.1746
21	-0.2474	0.9744
22	-0.0414	1.7590
23	0.0390	1.2264
24	0.1901	0.8928
25	0.9907	0.4461
26	1.0909	0.4813
27	1.1477	0.2479
28	1.0463	-0.2138
29	1.2322	-0.5217
30	1.2632	-0.2893
31	1.4369	-0.5365
32	1.4148	-0.7563
33	1.6418	-0.2011
34	1.4253	-0.9289
35	1.4877	-0.7148
36	1.5369	-1.1355

Varimax Rotation

Orthogonal Transformation Matrix

	1	2
1	0.99949	-0.03190
2	0.03190	0.99949

Country A Original Values Rotated Factor Pattern

	FACTOR1	FACTOR2
A1	0.89555	-0.39790
A2	-0.25663	0.92639
A3	0.77615	0.43380
A5	-0.12659	0.76173
A8	0.99130	-0.04996
A10	0.95190	-0.02739
A11	0.93204	0.00019
A12	0.40908	0.80553
A13	0.99138	-0.03494
A14	0.95822	-0.18241
A15	0.95581	0.09795
A20	0.97770	-0.05723
A17	0.91350	0.16659
A19	0.96709	-0.12190

Variance Explained by each Factor

FACTOR1	FACTOR2
9.951361	2.527045

Factor scores essentially the same as unrotated

Factor Analysis on X2, X5, X12

Eigenvalues of the Correlation Matrix

	1	2	3
EIGENVALUE	2.113945	0.614729	0.271325
DIFFERENCE	1.499216	0.343404	
PROPORTION	0.7046	0.2049	0.0904
CUMULATIVE	0.7046	0.9096	1.0000

Factor Loadings Matrix

	FACTOR1	FACTOR2
A2	0.91313	-0.05805
A5	0.77875	0.59844
A12	0.82078	-0.50321

Variance explained by each factor

FACTOR1	FACTOR2
2.113945	0.614729

Final Communality Estimates: Total = 2.728675

A2	A5	A12
0.837182	0.964584	0.926909

Factor Scores on Country A Original Values X2, X5, X12

OBS	FACTOR1	FACTOR2
1	-1.4450	0.9129
2	-1.3573	0.9113
3	-1.2758	0.5925
4	-1.2247	0.5859
5	-1.2133	0.5576
6	-1.1301	0.7192
7	-0.8901	0.5744
8	-0.7465	0.1948
9	-0.7866	0.1472
10	-0.0597	2.0099
11	-0.0989	0.8271
12	0.4794	-1.4406
13	0.5531	-1.5961
14	1.5622	1.9076
15	0.9184	-1.0620
16	0.8731	-1.8239
17	1.5570	-0.0751
18	1.8632	0.5589
19	1.3623	-0.0058
20	1.1230	0.2714
21	0.9312	-0.3190
22	1.7695	1.8685
23	1.1112	0.5126
24	0.7464	-0.2762
25	0.1313	-0.9394
26	0.3199	-0.3409
27	0.0220	-0.1853
28	-0.2499	-0.4672
29	-0.4447	-0.9543
30	-0.2456	0.8846
31	-0.7013	0.3504
32	-0.7692	-0.3294
33	-0.1461	-1.7224
34	-0.7456	-0.4507
35	-0.6530	-0.7314
36	-1.1397	-1.6673

Varimax rotation adds no additional information

Country A Relative Values.

	1	2	3	4	5
EIGENVALUE	2.546710	2.232499	1.802438	1.405323	1.245796
DIFFERENCE	0.314212	0.430061	0.397115	0.159527	0.082416
PROPORTION	0.1698	0.1488	0.1202	0.0937	0.0831
CUMULATIVE	0.1698	0.3186	0.4388	0.5325	0.6155

	6	7	8	9	10
EIGENVALUE	1.163380	1.002073	0.808632	0.744337	0.596160
DIFFERENCE	0.161307	0.193441	0.064295	0.148177	0.121548
PROPORTION	0.0776	0.0668	0.0539	0.0496	0.0397
CUMULATIVE	0.6931	0.7599	0.8138	0.8634	0.9032

	11	12	13	14	15
EIGENVALUE	0.474612	0.349542	0.276534	0.221441	0.130521
DIFFERENCE	0.125070	0.073007	0.055093	0.090920	
PROPORTION	0.0316	0.0233	0.0184	0.0148	0.0087
CUMULATIVE	0.9348	0.9581	0.9765	0.9913	1.0000

Country A Relative Values Factor Loadings Matrix

	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6	FACT7
DA1	0.476	0.575	-0.076	0.007	0.138	-0.028	-0.387
DA2	-0.135	-0.230	-0.143	0.557	0.221	0.387	0.047
DA3	0.336	-0.505	-0.123	0.086	0.085	0.529	-0.142
DA5	0.198	-0.343	-0.232	-0.295	0.420	-0.374	0.384
DA8	0.180	-0.098	0.723	0.288	-0.198	-0.356	-0.179
DA10	0.397	0.148	0.552	-0.238	0.388	-0.013	0.384
DA11	0.475	0.401	-0.363	0.178	-0.194	0.053	0.478
DA12	-0.111	0.453	0.400	-0.331	0.248	0.415	0.004
DA13	0.758	-0.083	0.200	-0.011	-0.059	0.280	0.114
DA14	0.454	0.049	-0.224	0.024	0.633	-0.067	-0.415
DA15	-0.423	0.492	0.459	0.283	0.226	-0.012	0.006
DA17	0.097	0.820	-0.227	0.147	-0.183	0.170	0.124
DA19	0.648	-0.321	0.420	0.239	-0.245	0.061	0.037
DA20	0.577	0.223	-0.231	-0.054	-0.204	-0.330	-0.202
Y	-0.003	-0.046	0.080	-0.746	-0.339	0.259	-0.177

Final Communality Estimates: Total = 11.398219

DA1	DA2	DA3	DA5	DA8
0.733030	0.603062	0.696885	0.760452	0.845490

DA10	DA11	DA12	DA13	DA14
0.838537	0.819114	0.721379	0.717409	0.836523

DA15	DA17	DA19	DA20	Y
0.764584	0.832886	0.820749	0.629709	0.778408

Country A Relative Values Factor Analysis Without Stability Index

	1	2	3	4	5
EIGENVALUE	2.546705	2.231444	1.800272	1.287595	1.186340
DIFFERENCE	0.315261	0.431173	0.512676	0.101256	0.152306
PROPORTION	0.1819	0.1594	0.1286	0.0920	0.0847
CUMULATIVE	0.1819	0.3413	0.4699	0.5619	0.6466

	6	7	8	9	10
EIGENVALUE	1.034033	0.901740	0.792929	0.662532	0.509212
DIFFERENCE	0.132293	0.108811	0.130397	0.153320	0.128608
PROPORTION	0.0739	0.0644	0.0566	0.0473	0.0364
CUMULATIVE	0.7205	0.7849	0.8415	0.8888	0.9252

	11	12	13	14
EIGENVALUE	0.380604	0.313249	0.222635	0.130710
DIFFERENCE	0.067355	0.090614	0.091925	
PROPORTION	0.0272	0.0224	0.0159	0.0093
CUMULATIVE	0.9524	0.9748	0.9907	1.0000

Country A Relative Values Factor Loadings Matrix

	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6
DA1	0.47604	0.57611	-0.07875	0.06493	0.08563	0.43058
DA2	-0.13512	-0.23959	-0.11769	-0.26608	0.59523	0.14169
DA3	0.33587	-0.50489	-0.12126	-0.08918	0.51382	-0.01687
DA5	0.19779	-0.34222	-0.23537	0.57356	-0.22050	-0.13007
DA8	0.17995	-0.09970	0.73434	-0.26690	-0.29868	0.32576
DA10	0.39692	0.15040	0.54770	0.47824	0.05760	-0.32422
DA11	0.47493	0.39626	-0.35650	-0.25369	-0.01589	-0.38141
DA12	-0.11075	0.46040	0.38290	0.32330	0.36474	-0.19981
DA13	0.75862	-0.08095	0.19661	-0.07597	0.19803	-0.23330
DA14	0.45360	0.04424	-0.21433	0.45614	0.25724	0.53789
DA15	-0.42387	0.48738	0.47409	0.00162	0.16693	0.15860
DA17	0.09654	0.81835	-0.22659	-0.26809	0.10653	-0.12933
DA19	0.64766	-0.32109	0.42674	-0.34206	0.00823	-0.01626
DA20	0.57657	0.22298	-0.23316	-0.06419	-0.37887	0.16977

Final Communality Estimates: Total = 10.086389

DA1	DA2	DA3	DA5	DA8	DA10	DA11
0.7617	0.5347	0.6547	0.6061	0.8481	0.8173	0.7198

DA12	DA13	DA14	DA15	DA17	DA19	DA20
0.6483	0.7182	0.8172	0.6950	0.8303	0.8220	0.6130

Factor Scores

OBS	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6
1	-1.7996	-0.2951	2.4138	-0.2838	-1.9384	1.8312
2	2.1591	2.6034	-1.6108	-1.7536	-0.3013	-2.2062
3	-0.5313	-0.5213	-0.1936	-0.1460	-0.7065	0.1979
4	-0.5838	0.4487	1.0135	0.4658	0.8716	-0.4820
5	0.4030	-0.9865	0.8509	-0.7509	-0.0238	-0.3084
6	-0.8350	-0.4550	-0.5503	0.2837	-0.3583	-0.2265
7	-0.6593	-1.0317	-0.4637	-1.2777	3.2367	0.8452
8	-0.5087	0.9034	1.1444	0.7687	0.3630	-0.3400
9	0.0960	-1.3303	-0.1337	-0.6693	0.7955	-0.5153
10	0.0723	-0.6754	-0.1753	1.6664	-0.7848	-1.0497

11	-0.6921	-1.1043	-0.7847	-0.9957	0.5650	0.4739
12	-0.6501	2.1188	1.3906	0.8649	1.3722	-0.6139
13	-0.5151	-0.2045	0.2262	-0.0717	-0.0687	-0.3897
14	0.6508	-1.6568	-0.6008	1.0041	-0.3698	-0.9674
15	0.1177	-0.3701	-0.1846	-0.4689	0.4903	-0.2721
16	0.0308	0.3268	-0.2961	-0.2468	0.2206	-0.6572
17	-0.0881	-0.5182	0.3324	0.8141	-0.6731	-0.1477
18	-0.3118	-0.6524	-0.4591	0.8260	0.4193	-0.1143
19	-1.1037	-0.8452	-0.8562	-0.2942	-0.0781	-0.3647
20	0.0077	0.3571	0.6175	-0.4098	0.6348	-0.9468
21	-0.0921	-0.0848	0.2274	-0.2812	-0.4345	-0.9469
22	2.2927	0.4991	-1.3886	2.8090	1.2466	3.1989
23	0.2568	0.5672	-0.7281	-0.7594	-0.4830	1.0849
24	-0.1142	1.5361	0.1787	-0.2741	-0.2192	0.6543
25	3.6120	-1.4404	2.8857	-1.7287	-0.2765	0.7921
26	0.8534	0.3089	-0.4993	0.4083	-0.8922	-0.1531
27	0.3406	0.2143	-1.1951	-1.0695	-0.6959	0.7581
28	-0.9341	1.3363	-0.3959	-0.6372	-0.8967	0.8955
29	0.7330	0.6214	0.9957	1.0404	-0.4335	-0.3328
30	0.2688	-1.0790	-0.8587	1.3111	-1.2104	-0.1614
31	-0.3726	-0.0283	-0.2931	-0.3362	0.3439	-1.0256
32	-0.5436	1.3412	-0.3775	-0.3786	-0.4400	1.7451
33	-0.0604	0.4045	1.1056	1.8740	0.6076	-1.4959
34	-0.4308	-0.6339	-1.3352	-0.6028	-2.1613	0.0067
35	-0.3476	-0.6090	-0.6049	0.0181	0.8621	-0.4720
36	-0.7204	0.9350	0.6025	-0.7387	0.4168	0.7063

Country A Relative Values Excluding Stability Index Varimax Rotation

Orthogonal Transformation Matrix

	1	2	3	4	5	6
1	0.71749	0.38337	0.33004	0.47881	0.00681	0.00194
2	-0.28002	0.55504	-0.49269	0.31126	0.35811	-0.38163
3	0.54180	-0.45805	-0.39788	-0.17727	0.51019	-0.21590
4	-0.32487	-0.31640	0.58787	0.32790	0.54980	-0.19738
5	-0.06181	0.06750	-0.17327	0.14857	0.41369	0.87658
6	-0.06232	-0.48008	-0.33824	0.71613	-0.37149	0.01965

Rotated Factor Pattern

	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6
DA1	0.084	0.317	-0.218	0.764	0.081	-0.131
DA2	-0.053	-0.075	-0.187	-0.016	-0.099	0.694
DA3	0.315	-0.025	0.272	0.060	-0.071	0.687
DA5	-0.054	-0.140	0.747	0.092	0.031	-0.127
DA8	0.640	-0.415	-0.399	0.026	-0.051	-0.323
DA10	0.401	-0.007	0.220	0.073	0.743	-0.225
DA11	0.144	0.828	0.086	0.055	-0.041	-0.045
DA12	-0.116	0.056	-0.221	0.040	0.762	-0.007
DA13	0.701	0.305	0.213	0.140	0.201	0.170

DA14	-0.001	-0.089	0.255	0.842	0.067	0.176
DA15	-0.204	-0.175	-0.650	0.004	0.425	-0.140
DA17	-0.194	0.749	-0.413	0.176	0.123	-0.119
DA19	0.897	-0.009	0.005	0.012	-0.071	0.106
DA20	0.259	0.365	0.144	0.431	-0.290	-0.350

Final Communality Estimates: Total = 10.086389

DA1	DA2	DA3	DA5	DA8	DA10	DA11
0.7617	0.5347	0.6547	0.6061	0.8481	0.8173	0.7198

DA12	DA13	DA14	DA15	DA17	DA19	DA20
0.6483	0.7182	0.8172	0.6950	0.8303	0.8220	0.6130

Factor scores show no additional information

Country A Relative Values Factor Analysis on X2, X5 and X12

EIGENVALUE	1.213978	1.033029	0.752993
DIFFERENCE	0.180949	0.280036	
PROPORTION	0.4047	0.3443	0.2510
CUMULATIVE	0.4047	0.7490	1.0000

Factor Loadings Matrix

	FACTOR1	FACTOR2
DA2	0.07447	0.95048
DA5	0.76595	-0.29894
DA12	-0.78851	-0.20061

Variance Explained by Each Factor

FACTOR1	FACTOR2
1.213978	1.033029

Final Communality Estimates: Total = 2.247007

DA2	DA5	DA12
0.908965	0.676048	0.661994

Factor scores and varimax rotation add little information

Country B Original Values

	1	2	3	4	5	6
EIGENVALUE	12.0128	2.2744	1.2966	0.4928	0.4229	0.2128
DIFFERENCE	9.7384	0.9778	0.8037	0.0699	0.2101	0.0537
PROPORTION	0.7066	0.1338	0.0763	0.0290	0.0249	0.0125
CUMULATIVE	0.7066	0.8404	0.9167	0.9457	0.9706	0.9831

	7	8	9	10	11	12
EIGENVALUE	0.1590	0.0575	0.0386	0.0168	0.0049	0.0048
DIFFERENCE	0.1015	0.0189	0.0219	0.0118	0.0001	0.0015
PROPORTION	0.0094	0.0034	0.0023	0.0010	0.0003	0.0003
CUMULATIVE	0.9924	0.9958	0.9981	0.9991	0.9994	0.9996

	13	14	15	16	17
EIGENVALUE	0.0033	0.0012	0.0010	0.0005	0.0001
DIFFERENCE	0.0021	0.0002	0.0005	0.0004	
PROPORTION	0.0002	0.0001	0.0001	0.0000	0.0000
CUMULATIVE	0.9998	0.9999	1.0000	1.0000	1.0000

Country B Original Values Factor Loadings

	FACTOR1	FACTOR2	FACTOR3
Y	0.57797	0.26036	-0.64869
B1	0.98379	-0.07447	0.09590
B2	0.88215	0.27640	-0.22074
B3	0.73883	0.52439	0.13962
B4	0.42598	-0.01828	0.79477
B6	0.83540	-0.45712	-0.16941
B8	0.93680	0.20782	-0.15819
B10	0.95342	0.02884	0.11852
B13	0.91380	-0.38602	0.00347
B16	0.89902	-0.38859	-0.03132
B17	0.95684	-0.27585	-0.02029
B19	0.98576	-0.13763	0.00775
B22	0.96551	0.02266	0.06084
B24	0.48400	0.75593	-0.11293
B25	0.95784	-0.26493	0.00747
B26	-0.90055	-0.02277	-0.10144
B27	0.54350	0.74741	0.26582

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR1	FACTOR2	FACTOR3
12.012772	2.274363	1.296573

FINAL COMMUNALITY ESTIMATES: TOTAL = 15.583707

Y	B1	B2	B3	B4	B6
0.8226	0.9826	0.9033	0.8403	0.8135	0.9356

B8	B10	B13	B16	B17	B19
0.9458	0.9239	0.9841	0.9602	0.9920	0.9907

B22	B24	B25	B26	B27
0.9364	0.8184	0.9877	0.8218	0.9247

Country B Original Values Excluding Stability Index

EIGENVALUES OF THE CORRELATION MATRIX

	1	2	3	4	5	6
EIGENVALUE	11.6986	2.2296	0.9562	0.4821	0.2856	0.1765
DIFFERENCE	9.4691	1.2734	0.4741	0.1965	0.1092	0.1007
PROPORTION	0.7312	0.1393	0.0598	0.0301	0.0179	0.0110
CUMULATIVE	0.7312	0.8705	0.9303	0.9604	0.9783	0.9893

	7	8	9	10	11	12
EIGENVALUE	0.0757	0.0570	0.0195	0.0068	0.0049	0.0042
DIFFERENCE	0.0187	0.0375	0.0126	0.0020	0.0007	0.0030
PROPORTION	0.0047	0.0036	0.0012	0.0004	0.0003	0.0003
CUMULATIVE	0.9940	0.9976	0.9988	0.9992	0.9995	0.9998

	13	14	15	16
EIGENVALUE	0.001221	0.001018	0.000661	0.000234
DIFFERENCE	0.000202	0.000358	0.000426	
PROPORTION	0.0001	0.0001	0.0000	0.0000
CUMULATIVE	0.9999	0.9999	1.0000	1.0000

FACTOR PATTERN

	FACTOR1	FACTOR2	FACTOR3
B1	0.98816	-0.05073	0.05030
B2	0.86944	0.25593	-0.23459
B3	0.73609	0.54632	0.03934
B4	0.44563	0.06644	0.86245
B6	0.83769	-0.46158	-0.16509
B8	0.92763	0.19693	-0.18669
B10	0.95476	0.04964	0.10530
B13	0.92000	-0.37103	-0.00864
B16	0.90505	-0.37602	-0.05680
B17	0.95989	-0.26546	-0.02809
B19	0.98843	-0.12326	-0.02854
B22	0.96522	0.03727	0.04743
B24	0.47086	0.74631	-0.23529
B25	0.96166	-0.25129	-0.00470
B26	-0.90226	-0.04210	-0.09521
B27	0.54399	0.78506	0.09201

VARIANCE EXPLAINED BY EACH FACTOR

FACTOR1	FACTOR2	FACTOR3
11.698610	2.229563	0.956191

FINAL COMMUNALITY ESTIMATES: TOTAL = 14.884364

B1	B2	B3	B4	B6	B8
0.9816	0.8764	0.8418	0.9468	0.9420	0.9341

B10	B13	B16	B17	B19	B22
0.9251	0.9841	0.9637	0.9926	0.9930	0.9353

B24	B25	B26	B27
0.834041	0.987957	0.824914	0.920704

Country B Original Values Excluding Stability Index Factor Scores

OBS	FACTOR1	FACTOR2	FACTOR3
1	-0.74795	-0.5279	2.8343
2	-0.80567	-0.5450	2.3841
3	-0.82541	-0.5297	2.0424
4	-0.81905	-0.4813	1.2070
5	-0.84397	-0.4610	1.3011
6	-0.86281	-0.5109	1.1934
7	-0.84581	-0.4532	0.5558
8	-0.88486	-0.4211	-0.6241
9	-0.87309	-0.4655	-0.5457
10	-0.90570	-0.3427	-1.1751
11	-0.86065	-0.3218	-0.1029
12	-0.80336	-0.2046	-0.2442
13	-0.74231	-0.0017	-0.4920
14	-0.71758	0.0187	-0.6663
15	-0.67417	0.0200	-0.8389
16	-0.59461	0.0866	-1.1569
17	-0.53354	0.1247	-0.8202
18	-0.48684	0.2663	-0.8197
19	-0.45935	0.2678	-0.8766
20	-0.39194	0.3076	-0.9287
21	-0.37244	0.3136	-0.7474
22	-0.32319	0.3380	-0.6962
23	-0.29793	0.4188	-0.6601
24	-0.19701	0.4197	-0.6153
25	-0.01182	0.4316	-0.4681
26	0.04730	0.2914	-0.6301
27	0.16040	0.4317	-0.5582
28	0.44544	1.0158	-0.5585
29	0.65108	1.4112	0.6629
30	0.90111	1.9186	0.7157
31	1.06821	1.7109	0.6528
32	1.59103	1.6037	0.8552
33	1.87921	1.9926	0.4319
34	1.89360	0.0412	0.3600
35	1.72350	-1.5257	0.4103
36	1.79277	-2.3978	-0.2916
37	1.83885	-1.9615	-0.4555
38	1.88856	-2.2788	-0.6345

Country B Original Values Excluding Stability Index Varimax Transformation

ORTHOGONAL TRANSFORMATION MATRIX

	1	2	3
1	0.86283	0.46346	0.20182
2	-0.48431	0.87229	0.06743
3	-0.14479	-0.15592	0.97710

ROTATED FACTOR PATTERN

	FACTOR1	FACTOR2	FACTOR3
B1	0.86990	0.40587	0.24515
B2	0.66019	0.66277	-0.03649
B3	0.36483	0.81157	0.22384
B4	0.22745	0.13001	0.93711
B6	0.97024	0.01135	-0.02337
B8	0.73204	0.63080	0.01808
B10	0.78451	0.46937	0.29893
B13	0.97475	0.10408	0.15222
B16	0.97123	0.10031	0.10180
B17	0.96085	0.21769	0.14837
B19	0.91668	0.35503	0.16329
B22	0.80790	0.47246	0.24366
B24	0.07889	0.90591	-0.08455
B25	0.95213	0.22722	0.17254
B26	-0.74433	-0.44004	-0.27796
B27	0.07584	0.92257	0.25262

FINAL COMMUNALITY ESTIMATES: TOTAL = 14.884364

B1	B2	B3	B4	B6	B8
0.9815	0.8764	0.8418	0.9468	0.9420	0.9341

B10	B13	B16	B17	B19	B22
0.9251	0.9841	0.9637	0.9926	0.9930	0.9353

B24	B25	B26	B27
0.8340	0.9879	0.8249	0.9207

Rotated Factor Scores

OBS	FACTOR1	FACTOR2	FACTOR3
1	-0.80007	-1.2491	2.5829
2	-0.77640	-1.2206	2.1302
3	-0.75137	-1.1631	1.7933
4	-0.64839	-0.9876	0.9816
5	-0.69335	-0.9961	1.0699
6	-0.66979	-1.0316	0.9574

7	-0.59075	-0.8740	0.3418
8	-0.46919	-0.6801	-0.8168
9	-0.44885	-0.7256	-0.7408
10	-0.44531	-0.5355	-1.3541
11	-0.57184	-0.6635	-0.2960
12	-0.55870	-0.5127	-0.4145
13	-0.56841	-0.2688	-0.6306
14	-0.53171	-0.2124	-0.7946
15	-0.46990	-0.1642	-0.9544
16	-0.38748	-0.0196	-1.2446
17	-0.40197	-0.0106	-0.9007
18	-0.43034	0.1345	-0.8812
19	-0.39913	0.1574	-0.9311
20	-0.35269	0.2315	-0.9658
21	-0.36502	0.2175	-0.7843
22	-0.34175	0.2536	-0.7227
23	-0.36429	0.3301	-0.6769
24	-0.28415	0.3707	-0.6127
25	-0.15146	0.4440	-0.4306
26	-0.00909	0.3744	-0.5865
27	0.01014	0.5380	-0.4840
28	-0.02674	1.1796	-0.3873
29	-0.21767	1.4294	0.8743
30	-0.25534	1.9796	1.0105
31	-0.00143	1.8857	0.9688
32	0.47228	2.0029	1.2649
33	0.59384	2.5418	0.9356
34	1.56176	0.8574	0.7367
35	2.16661	-0.5961	0.6459
36	2.75036	-1.2153	-0.0848
37	2.60255	-0.7878	-0.2062
38	2.82504	-1.0136	-0.3925

Country B Original Values with X4, X8, X22, X25 and X26

	1	2	3	4	5
EIGENVALUE	3.8155	0.8097	0.1963	0.1257	0.0525
DIFFERENCE	3.0057	0.6134	0.0705	0.0732	
PROPORTION	0.7631	0.1620	0.0393	0.0252	0.0105
CUMULATIVE	0.7631	0.9251	0.9643	0.9895	1.0000

FACTOR PATTERN

	FACTOR1	FACTOR2	FACTOR3
B4	0.54111	0.83695	0.02241
B8	0.91488	-0.27287	-0.17448
B22	0.96225	-0.11655	0.15809
B25	0.93927	-0.13942	0.26215
B26	-0.93678	-0.04255	0.26778

FINAL COMMUNALITY ESTIMATES: TOTAL = 4.821661

B4	B8	B22	B25	B26
0.993796	0.941902	0.964504	0.970382	0.951077

Country B Original Values X4, X8, X22, X25, and X26 Factor Scores

OBS	FACTOR1	FACTOR2	FACTOR3
1	-0.3292	2.9546	-0.2691
2	-0.5237	2.4518	0.4200
3	-0.6119	2.0885	0.6221
4	-0.6578	1.1509	0.0871
5	-0.7492	1.2915	0.7687
6	-0.7847	1.1796	0.9145
7	-0.7843	0.4806	0.3221
8	-1.0164	-0.8830	0.4896
9	-0.9503	-0.7724	0.3463
10	-1.0991	-1.3012	0.7817
11	-0.9515	-0.0889	1.1909
12	-0.8830	-0.1656	0.8355
13	-0.8290	-0.4136	0.4417
14	-0.8420	-0.5911	0.5010
15	-0.7906	-0.8335	0.1763
16	-0.6935	-1.2250	-0.4599
17	-0.5802	-0.9130	-0.5724
18	-0.5860	-0.8237	-0.2389
19	-0.5862	-0.8455	-0.0363
20	-0.5152	-0.8771	-0.2061
21	-0.4642	-0.6513	-0.1792
22	-0.3719	-0.4331	-0.3577
23	-0.4019	-0.2980	0.1230
24	-0.2672	-0.3029	-0.2831
25	0.1689	-0.1120	-2.1814
26	0.2689	-0.2412	-2.4455
27	0.3145	-0.1220	-2.0727
28	0.5046	-0.1373	-2.0460
29	0.8045	0.9782	-1.4705
30	0.9050	0.6888	-0.9608
31	1.0189	0.5234	-0.2212
32	1.5072	0.7051	0.0945
33	1.8308	0.0201	0.7109
34	2.1333	-0.8129	0.5134
35	1.8791	-0.3477	1.7977
36	1.7451	-0.4058	0.5389
37	1.6904	-0.4601	0.4523
38	1.4978	-0.4551	1.8724

Varimax rotation added little additional information

Country B Relative Change Values Including Stability Index

	1	2	3	4	5	6
EIGENVALUE	3.5587	2.2409	1.9886	1.7464	1.4810	1.2344
DIFFERENCE	1.3177	0.2523	0.2421	0.2653	0.2466	0.2153
PROPORTION	0.2093	0.1318	0.1170	0.1027	0.0871	0.0726
CUMULATIVE	0.2093	0.3412	0.4581	0.5609	0.6480	0.7206

	7	8	9	10	11	12
EIGENVALUE	1.0191	0.8903	0.7896	0.5444	0.4438	0.3104
DIFFERENCE	0.1288	0.1006	0.2452	0.1005	0.1333	0.0224
PROPORTION	0.0600	0.0524	0.0465	0.0320	0.0261	0.0183
CUMULATIVE	0.7806	0.8329	0.8794	0.9114	0.9375	0.9558

	13	14	15	16	17
EIGENVALUE	0.2879	0.2515	0.1445	0.0522	0.0153
DIFFERENCE	0.0364	0.1070	0.0922	0.0368	
PROPORTION	0.0169	0.0148	0.0085	0.0031	0.0009
CUMULATIVE	0.9727	0.9875	0.9960	0.9991	1.0000

FACTOR PATTERN

	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6	FACT7
Y	0.360	-0.384	-0.615	-0.138	-0.150	0.209	-0.305
DB1	0.717	0.298	0.091	-0.470	-0.076	-0.219	-0.007
DB2	0.163	-0.644	-0.005	-0.157	0.524	-0.150	0.098
DB3	0.069	-0.473	0.641	0.289	0.163	-0.080	-0.081
DB4	-0.318	0.224	0.325	0.334	0.349	0.654	-0.127
DB6	0.358	0.495	-0.587	0.031	0.259	-0.160	-0.086
DB8	0.260	0.365	0.262	0.036	0.351	-0.498	-0.286
DB10	0.185	0.179	0.188	-0.445	-0.436	0.337	-0.040
DB13	0.700	-0.225	-0.038	0.404	-0.319	0.098	0.174
DB16	0.521	0.144	-0.317	0.498	0.116	0.034	0.379
DB17	0.692	0.260	0.004	0.372	-0.013	0.149	0.165
DB19	0.457	0.491	0.328	-0.280	0.429	0.200	0.049
DB22	0.623	-0.171	0.454	0.119	-0.087	-0.032	0.102
DB24	-0.110	0.199	0.165	-0.510	-0.001	0.164	0.514
DB25	0.669	-0.404	0.295	-0.222	-0.202	-0.025	-0.164
DB26	-0.499	0.177	0.193	0.179	-0.361	-0.437	0.363
DB27	-0.009	0.506	0.257	0.314	-0.408	-0.048	-0.404

FINAL COMMUNALITY ESTIMATES: TOTAL = 13.269540

Y	DB1	DB2	DB3	DB4	DB6
0.8352	0.8877	0.7744	0.7640	0.9374	0.8216

DB8	DB10	DB13	DB16	DB17	DB19
0.7262	0.6071	0.8486	0.8005	0.7361	0.8645

DB22	DB24	DB25	DB26	DB27
0.6578	0.6319	0.8165	0.8049	0.7543

Country B Relative Values Excluding Stability Index

	1	2	3	4	5	6
EIGENVALUE	3.4726	2.1926	1.7729	1.6356	1.4438	1.1920
DIFFERENCE	1.2799	0.4197	0.1372	0.1917	0.2518	0.2482
PROPORTION	0.2170	0.1370	0.1108	0.1022	0.0902	0.0745
CUMULATIVE	0.2170	0.3541	0.4649	0.5671	0.6574	0.7319

	7	8	9	10	11	12
EIGENVALUE	0.9437	0.7965	0.7545	0.5258	0.4434	0.2930
DIFFERENCE	0.1471	0.0420	0.2286	0.0824	0.1503	0.0351
PROPORTION	0.0590	0.0498	0.0472	0.0329	0.0277	0.0183
CUMULATIVE	0.7908	0.8406	0.8878	0.9207	0.9484	0.9667

	13	14	15	16
EIGENVALUE	0.2578	0.1709	0.0820	0.0220
DIFFERENCE	0.0869	0.0888	0.0600	
PROPORTION	0.0161	0.0107	0.0051	0.0014
CUMULATIVE	0.9828	0.9935	0.9986	1.0000

FACTOR PATTERN

	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6
DB1	0.735	0.238	0.458	-0.155	-0.135	0.188
DB2	0.128	-0.619	-0.022	-0.505	0.327	0.090
DB3	0.099	-0.679	-0.018	0.417	0.302	0.218
DB4	-0.276	0.107	-0.069	0.498	0.647	-0.426
DB6	0.344	0.645	-0.281	-0.421	0.092	0.120
DB8	0.314	0.232	0.101	0.119	0.378	0.675
DB10	0.195	0.126	0.541	0.155	-0.320	-0.353
DB13	0.678	-0.227	-0.397	0.174	-0.311	-0.192
DB16	0.516	0.200	-0.604	-0.073	0.028	-0.154
DB17	0.710	0.208	-0.301	0.214	0.045	-0.164
DB19	0.520	0.331	0.420	0.043	0.516	-0.108
DB22	0.662	-0.354	0.047	0.234	-0.056	-0.028
DB24	-0.086	0.147	0.544	-0.088	0.011	-0.235
DB25	0.647	-0.481	0.285	0.064	-0.165	0.065
DB26	-0.451	0.097	-0.037	0.297	-0.365	0.318
DB27	0.038	0.394	-0.017	0.690	-0.149	0.247

FINAL COMMUNALITY ESTIMATES: TOTAL = 11.709787

DB1	DB2	DB3	DB4	DB6	DB8
0.8859	0.7718	0.7860	0.9430	0.8159	0.7758

DB10	DB13	DB16	DB17	DB19	DB22
0.5999	0.8342	0.7032	0.7151	0.8379	0.6259

DB24	DB25	DB26	DB27
0.3888	0.7686	0.5389	0.7182

Country B Relative Values Excluding Stability Index Factor Scores

OBS	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6
1	-1.6622	0.0615	0.1193	-0.4650	-0.9315	0.6043
2	-1.1137	2.0837	0.1790	4.2481	-0.9129	0.4902
3	-1.0461	0.2222	-0.0085	0.3406	0.7991	0.1313
4	-0.0685	0.7415	0.0413	0.7080	2.6209	-1.3632
5	-1.2946	-0.2839	0.2585	-0.1806	-1.0405	0.4332
6	-0.8210	0.4109	-0.4979	0.3000	-0.1926	0.4364
7	-0.6936	0.4346	0.3303	0.4765	1.1479	-0.5538
8	-0.1848	0.1843	-0.2430	1.2145	2.0061	-0.4898
9	1.0542	1.5985	1.4674	-0.9996	1.5708	1.8246
10	-0.9796	0.2767	1.6350	-0.9222	-0.1497	-1.0680
11	0.7177	1.0023	0.9742	-0.1847	-1.0792	2.2924
12	1.0977	1.0157	2.8509	0.3548	-1.0582	-1.8714
13	-0.3318	-2.2598	0.9903	0.3919	1.6220	1.4233
14	0.1192	-1.4250	-0.1951	-0.8990	0.7360	0.3491
15	-0.3786	-0.6029	0.2387	-0.6214	1.2112	0.9764
16	0.6634	-0.3234	-0.7538	0.1081	0.9689	0.2363
17	-0.2366	-0.8233	0.0298	-0.2953	-0.0925	1.0519
18	-0.4231	-0.5612	-0.4024	-0.1175	-0.1044	0.4574
19	-0.4379	-0.5709	-0.4650	-0.1126	-0.2468	0.2603
20	0.7339	-0.0447	-1.5982	0.1756	-0.2554	-0.2632
21	-0.6396	-0.3169	0.2575	-0.3853	-0.7578	-0.2747
22	-0.5221	-0.0605	0.2067	-0.7693	-0.3084	-0.3174
23	0.0875	0.7146	0.9781	-0.2302	-0.5923	0.0784
24	0.8056	0.2999	-0.0644	-0.0667	-0.1201	-0.5247
25	0.6549	-0.3843	1.0214	-1.2165	0.7412	-0.5515
26	0.2972	0.3256	0.1889	-0.6467	-0.2913	-0.5313
27	0.5050	0.1963	0.6685	-0.0102	-0.6872	0.0153
28	1.7002	-0.7955	-0.2615	1.3029	-0.0583	0.0343
29	0.5995	-1.2928	-0.1812	0.1879	-2.4721	1.6834
30	1.0216	-1.8131	-0.3785	1.5001	-0.3160	-0.9007
31	0.9478	-0.5239	-1.0090	0.4617	-0.8333	-0.4198
32	3.3846	1.2242	-0.7146	-0.9863	-0.2575	-0.3838
33	0.1359	-1.6546	0.8423	0.8921	0.0716	-0.8457
34	0.3446	0.5085	-2.7628	0.1522	0.6275	0.9464
35	-0.9802	0.1983	-1.3107	-1.4888	-0.9869	-1.7002
36	-0.5482	2.4800	-1.6917	-0.9877	0.1386	0.1874
37	-1.6187	0.3321	0.0903	-0.8892	0.0486	0.5718
38	-0.8895	-0.5748	-0.8302	-0.3403	-0.5655	-2.4248

Varimax Rotation of Country B Relative Values Excluding Stability Index

ROTATED FACTOR PATTERN

	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6
DB1	0.296	-0.027	0.573	-0.046	0.497	-0.467
DB2	-0.067	0.280	0.058	-0.780	-0.239	-0.137
DB3	0.015	0.816	0.108	-0.082	-0.275	0.157
DB4	-0.032	0.087	0.006	0.089	0.014	0.962
DB6	0.328	-0.717	0.396	-0.075	-0.113	-0.133
DB8	-0.025	0.070	0.833	0.146	-0.218	-0.078
DB10	0.067	0.065	-0.080	0.160	0.742	-0.088
DB13	0.838	0.241	-0.153	0.012	-0.030	-0.218
DB16	0.747	-0.275	0.052	-0.075	-0.243	0.028
DB17	0.800	-0.032	0.240	0.086	0.052	0.075
DB19	0.206	-0.047	0.680	-0.164	0.467	0.289
DB22	0.531	0.512	0.154	-0.080	0.157	-0.161
DB24	-0.267	-0.084	0.037	-0.071	0.547	0.064
DB25	0.350	0.585	0.165	-0.200	0.281	-0.395
DB26	-0.344	0.019	-0.189	0.568	-0.192	-0.152
DB27	0.109	0.071	0.221	0.801	0.003	0.103

FINAL COMMUNALITY ESTIMATES: TOTAL = 11.709787

DB1	DB2	DB3	DB4	DB6	DB8
0.885920	0.771866	0.786004	0.943035	0.815927	0.775879

DB10	DB13	DB16	DB17	DB19	DB22
0.599966	0.834225	0.703226	0.715197	0.837912	0.625922

DB24	DB25	DB26	DB27
0.388823	0.768685	0.538927	0.718274

Factor Scores

OBS	FACT1	FACT2	FACT3	FACT4	FACT5	FACT6
1	-1.5272	-0.4931	-0.8623	0.4902	-0.4245	-0.7005
2	-0.2204	0.4103	0.1388	4.7260	0.3920	1.4174
3	-0.8805	-0.1045	0.1066	0.2251	-0.4150	0.9461
4	0.2258	-0.2703	0.8694	-0.5609	0.3710	2.9074
5	-1.2132	-0.0126	-0.9184	0.4814	-0.1765	-0.7402
6	-0.4481	-0.3661	-0.2260	0.7481	-0.6714	0.1102
7	-0.5570	-0.1478	0.2357	0.0329	0.2588	1.4747
8	0.1156	0.4397	0.7291	0.0654	-0.2888	2.2451
9	0.7124	-0.9231	3.2705	-0.4555	0.4110	-0.4280
10	-1.3511	-0.6376	-0.5870	-0.6649	1.6383	0.1419
11	-0.4954	-0.2846	1.6536	1.1654	0.1502	-2.1170
12	0.2869	-0.1260	0.0415	0.3841	3.8513	-0.1802
13	-1.4340	2.4748	1.0607	-1.0216	-0.7683	0.2611
14	-0.2242	0.7382	0.0904	-1.5241	-0.7597	-0.2262
15	-0.9891	0.3664	0.8775	-0.9307	-0.7806	0.1098

16	0.7104	0.3359	0.6274	-0.4841	-0.8034	0.4778
17	-0.6161	0.6186	0.1657	-0.2465	-0.7217	-0.7521
18	-0.3186	0.2856	-0.2934	-0.0927	-0.7376	-0.2608
19	-0.2214	0.2422	-0.5083	-0.0784	-0.6627	-0.2527
20	1.4976	-0.1781	-0.4227	0.0954	-0.8933	0.0104
21	-0.5391	-0.0732	-0.8884	-0.0845	0.2652	-0.4596
22	-0.5052	-0.4475	-0.5594	-0.4663	0.2193	-0.2697
23	-0.3687	-0.4707	0.2815	0.3573	0.9868	-0.5889
24	0.8500	-0.2421	0.0832	-0.1266	0.4824	-0.0213
25	-0.1089	-0.0170	0.5139	-1.6598	0.9585	-0.0577
26	0.2547	-0.5947	-0.1746	-0.3991	0.5799	0.2660
27	0.1489	0.0352	0.1283	0.2560	0.8023	-0.6812
28	1.6277	1.5156	0.4499	0.3662	0.0848	-0.0583
29	0.2573	1.2774	-0.5702	0.9101	-0.6184	-2.7947
30	1.4515	2.1406	-0.8887	0.0497	0.1784	0.3498
31	1.5096	0.4635	-0.7046	0.2321	-0.2708	-0.3964
32	3.0701	-1.1761	1.3521	-0.6986	0.6642	-1.0416
33	0.0073	1.8722	-0.6635	-0.3781	0.8263	0.4586
34	1.3093	-0.7337	0.4030	0.3733	-2.5778	0.3518
35	0.2877	-1.6861	-2.2767	-0.8032	-0.2103	-0.0264
36	0.2996	-2.9222	0.2449	0.5291	-1.1340	0.2965
37	-1.6291	-0.8735	-0.2686	-0.1201	-0.5790	-0.1404
38	0.4498	-0.4353	-2.5108	-0.6922	0.3730	0.9011

Country B Relative Values with X4, X8, X22, X25, and X26

	1	2	3	4	5
EIGENVALUE	1.788580	1.063160	0.989346	0.767100	0.391813
DIFFERENCE	0.725420	0.073814	0.222246	0.375287	
PROPORTION	0.3577	0.2126	0.1979	0.1534	0.0784
CUMULATIVE	0.3577	0.5703	0.7682	0.9216	1.0000

FACTOR PATTERN

	FACTOR1	FACTOR2	FACTOR3
DB4	-0.40970	-0.69748	0.36747
DB8	0.19411	0.35987	0.90689
DB22	0.74639	-0.05960	-0.13301
DB25	0.88211	0.02296	0.01720
DB26	-0.49783	0.66566	-0.11775

FINAL COMMUNALITY ESTIMATES: TOTAL = 3.841086

DB4	DB8	DB22	DB25	DB26
0.789361	0.989644	0.578336	0.778944	0.704801

Country B Relative Values on X4, X8, X22, X25, X26 Factor Scores

OBS	FACTOR1	FACTOR2	FACTOR3
1	-1.4867	1.5893	-0.5820
2	-1.4778	-0.1242	0.5564
3	-1.0603	-0.2684	0.4330
4	-0.7572	-2.0393	1.4661
5	-0.6859	1.1514	-0.5903
6	-0.5418	0.2263	0.0688
7	-0.7671	-1.3193	0.8287
8	-1.0463	-0.9904	1.0491
9	0.4892	0.8670	1.7490
10	-0.5318	0.3276	-0.0462
11	1.0802	1.9671	0.3219
12	0.5000	-0.2160	0.1245
13	0.6646	-0.2354	0.5263
14	0.2499	0.0609	-0.0556
15	0.2271	-0.2078	0.5153
16	0.4180	-0.4114	1.0104
17	0.4837	0.5208	0.1356
18	-0.0963	0.7111	-0.3609
19	-0.3482	0.4820	-0.0917
20	0.1297	0.2048	0.0950
21	-0.0801	0.0109	-0.7709
22	-0.1877	-0.0276	-0.6283
23	-0.4528	0.6582	-0.6645
24	0.4872	-0.5233	-0.4232
25	1.4535	-1.9432	0.4400
26	0.3558	-0.5248	-0.1318
27	0.3744	0.4935	-0.7712
28	1.2779	0.3024	0.1942
29	1.3961	2.3970	-0.8767
30	0.9769	-0.6028	-0.5140
31	0.6273	0.5143	-0.4883
32	2.4278	0.0343	-0.2534
33	1.6590	-1.5014	0.4221
34	-0.2159	-0.0992	1.8393
35	-0.9782	-1.3338	-2.9472
36	-1.9964	0.3070	1.2181
37	-1.8686	1.2413	0.2636
38	-0.6994	-1.6984	-3.0614

Varimax rotation adds no additional insight

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[redacted]

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REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution unlimited
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) AFIT/GOR/ENS/90M-19	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION School of Engeneering	6b. OFFICE SYMBOL (If applicable) AFIT/ENS
7a. NAME OF MONITORING ORGANIZATION	
6c. ADDRESS (City, State, and ZIP Code) Air Force Institute of Technology Wright-Patterson AFB OH 45433-6583	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING / SPONSORING ORGANIZATION Defense Intelligence Agency	8b. OFFICE SYMBOL (If applicable) DB-5E3
9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	
8c. ADDRESS (City, State, and ZIP Code) DIA/DB5-E3 Bolling AFB, MD	10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO	WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)
CLASSIFICATION AND CAUSAL MODELING OF ECONOMIC INDICATORS OF INSTABILITY IN DEVELOPING NATIONS

12. PERSONAL AUTHOR(S)
James W. Wisnowski, B.S., 1st Lt, USAF

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
MS Thesis	FROM ______ TO ______	1990 March	154

16. SUPPLEMENTARY NOTATION

17. COSATI CODES

FIELD	GROUP	SUB-GROUP
12	03	
05	03	

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
Economic Indicators, Logit Analysis, Factor Analysis, Principal Components Analysis, Cluster Analysis

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

Thesis Advisor: James N. Robinson
Assistant Professor
Department of Operational Sciences

Abstract:
This study examined the relationships between several economic times series and an aggregate stability index for developing nations. The hypothesis is that worsening economic conditions in developing nations may be a driving force behind unstable conditions in work, social, military, or political domains. The objectives were to identify economic time series that may serve as indicators of instability and to develop a predictive methodology of instability given the economic input.

Classifcation of the economic series paralleled the U.S economic indicators of the business cycle. The series were classified as leading, lagging, coincident, (OVER)

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL James N. Robinson, Assistant Professor	22b. TELEPHONE (Include Area Code) (513) 255-3362
22c. OFFICE SYMBOL ENS	

DD Form 1473, JUN 86 *Previous editions are obsolete.* SECURITY CLASSIFICATION OF THIS PAGE

Block 19
Abstract: (Continued)

or unrelated to the stability index. Graphical and cross-correlation analysis were used to determine the type and strength of these relationships.

The causal models used regression, logit, cluster, and factor analysis. Regression analysis using both principal components and relative change values from the previous period was used to see to see if a subset of the economic series was statistically significant when regressed against the stability index. Logit analysis was used to map a probability of instability given the economic input. Cluster analysis on the economic data was used to see if the groups of quarterly observations had any significant relationship to the stability index. Factor analysis was used to assess the dimensionality and to determine if certain factors could be associated with the stability based on factor scores and factor loadings.